Ontario

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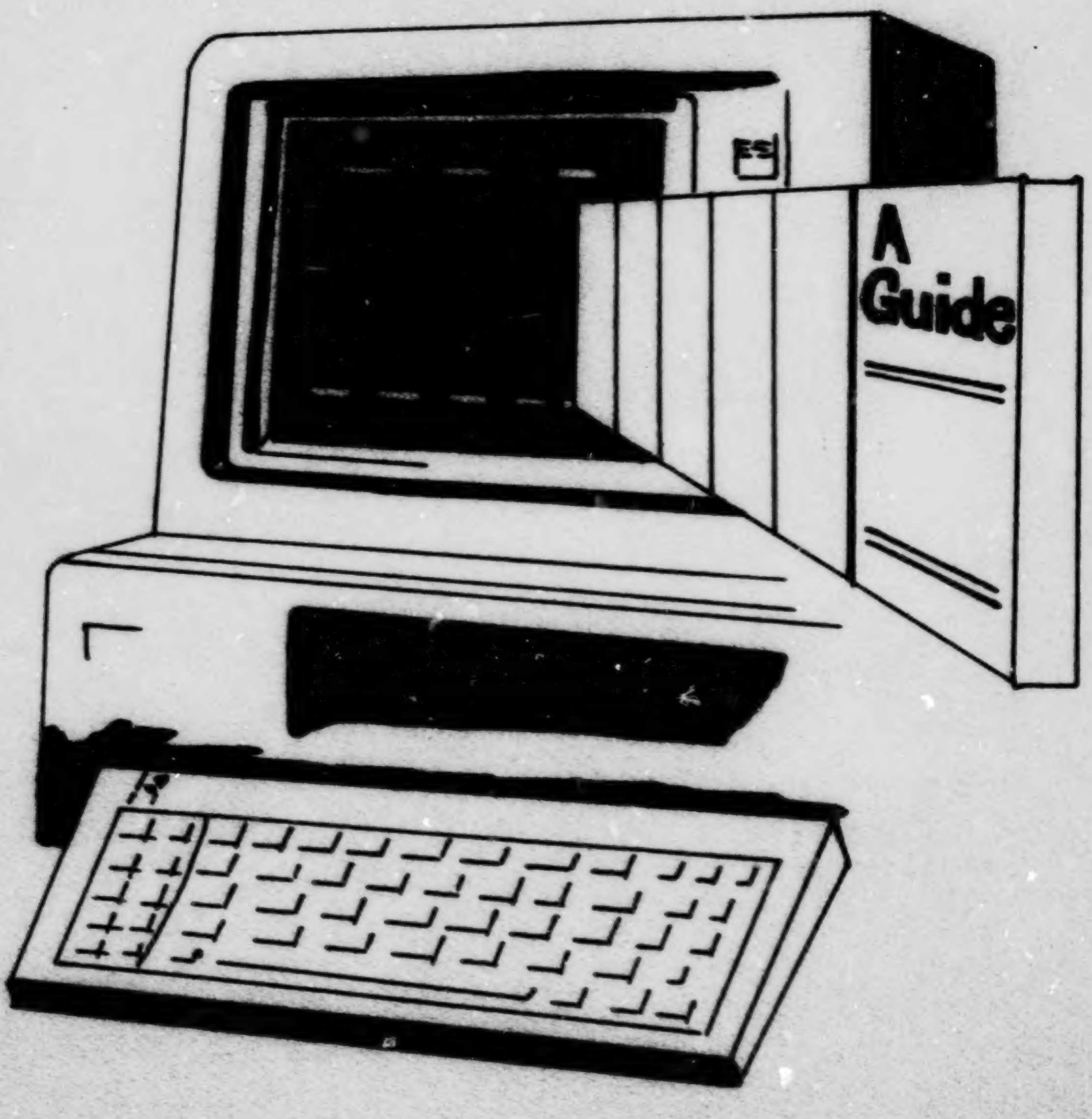
Advisory
Publication

Microcomputers in Small Municipalities



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Microcomputers in Small Municipalities

A Guide

Ontario

Ministry of
Municipal Affairs
and Housing

Honourable
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Minister

Ward Cornell
Deputy Minister

May 1984

MICROCOMPUTERS IN SMALL MUNICIPALITIES: A GUIDE

TABLE OF CONTENTS

PAGE

Preface i

1 - INTRODUCTION

A Microcomputer Defined 1
Goals 2
Scope 2
How to Use This Guide and Workbook 3

2 - WHAT A COMPUTER SYSTEM IS AND HOW IT WORKS

What is a Computer? 8
The Three Main Classes of Computers 8
Basic Elements of a Microcomputer System 10
Chips, Bits and Bytes 11
Hardware
    The Central Processing Unit (CPU) 12
    Memory and Memory-related Devices 13
    Input/Output Devices 17
    Communications 19
Software
    Operating Software 21
    Applications Software 23
How Do You Make the Computer Work? 23

3 - THE USES OF MICROCOMPUTERS: IS THERE A MICROCOMPUTER IN YOUR MUNICIPALITY'S FUTURE?

The Evolution of Microcomputers 25
Packages, Generic Packages, and Functional Packages Defined 26
The Microcomputer as a Productivity Tool 28
Municipal Uses of Generic Packages 30
The Microcomputer as a "Central" Computer in Small Municipalities 30
A Multi-purpose Microcomputer 31
Benefits of Using a Microcomputer 32
Planning for Your Municipal Microcomputer 35

PAGE

4 - GETTING STARTED

Where to Get Experienced Assistance 36
Objectives of Preliminary Planning 38
Steps
1. Identify Applications 40
2. Consider Benefits and Risks 41
3. Define Goals and Priorities 41
4. Draw Up a Microcomputer Applications Plan 42
5. Consider the Operational Issues 42
6. Investigate the Technical Issues 43
7. Assess the Economic Issues 52
8. What are the Alternatives?. 54
9. Report to Council 57

5 - DEFINING YOUR REQUIREMENTS

Sharing the Load 58
The Five Main Steps in Defining Your Requirements . . 59
1. Define Your Application Requirements 59
2. Determine Volumes 62
3. Analyse Capacity 63
4. Define Hardware and Operating System Requirements 64
5. Review and Revise Requirements 66

6 - SELECTING THE VENDOR

The Marketplace 67
The Vendor Selection Process 68
Two Approaches to Selection 68
1. Identifying Qualified Vendors 70
2. Dealing With Vendors 72
3. Evaluating Vendor Responses 73
4. Selecting the Best Vendor 73
5. Keeping Council Informed 75
6. Negotiating with the Chosen Vendor 75

7 - IMPLEMENTING YOUR MICROCOMPUTER SYSTEM

1. Draw Up an Implementation Schedule 77
2. Assign Staff Responsibilities 78
3. Establish Project Management Procedures 80
4. Vendor Verifies the Requirements Fit 80
5. Study the Application Documentation 80
6. Prepare the Physical Site 82
7. Order Forms, Supplies and Training Material . . . 82
8. Install Computer 83
9. Complete the Basic Systems Training 83
10. Implement Application #1 84
11 and 12. Implement Other Applications 88
Installing a Generic Package 89

PAGE

8 - OPERATING YOUR MICROCOMPUTER

Operations Responsibilities 90
Backup Procedures 90
Operating Controls 91
Documentation 92
Security 92
Service and Maintenance 93
Dealing With Breakdowns 95
Handling Diskettes 96
Expanding Your System 97
Conclusion 98

9 - FUTURE TRENDS

Obsolescence 100
Marketplace 100
Technology 101
The Evolving Role of Microcomputers 101

EXHIBITS

1. Summary of Guidelines 6

2. Municipal Microcomputer Applications 33

3. Estimated Costs of Microcomputing 39

4. Sample Cost/Benefit Analysis 53

5. Comparison of Alternatives 56

6. Implementation Schedule 79

7. Source of Education and Training 135

TABLES

1. Generic and Functional Packages 28

2. A Possible Configuration 48

3. Formal vs. Informal Selection Approach 69

4. Accommodating Growth 98

APPENDICES

A - Glossary 103

B - Help: Sources of Information/Advice and
Education/Training 128
Bibliography 137

C - Trade Marks and Registered Names 139

PREFACE

In accordance with its mandate to support municipal initiatives, the Ministry of Municipal Affairs and Housing has produced two series of publications about microcomputers. Since the size of a municipality is likely to influence the way in which it makes use of microcomputers, one series of publications has been produced for small municipalities (those with populations of about 5,000 or less), and the other for larger municipalities.

The first series, entitled Microcomputers in Small Municipalities, comprises four publications:

- A Guide
- A Workbook
- A Catalogue
- Case Studies.

The Guide describes the issues and concerns associated with the acquisition and use of microcomputers by small municipalities. The Workbook provides tools to be used when completing the tasks of acquiring and using a microcomputer. The Catalogue provides information about vendors of hardware and software as well as identifying small municipalities that are using microcomputers. The Case Studies describes the experiences of selected small municipalities that have installed microcomputer systems.

The second series, for larger municipalities, is entitled Microcomputers in Local Government. It comprises four publications:

- A Manual
- A Workbook
- A Catalogue
- Case Studies.

The Manual deals with the use of microcomputers in larger municipalities and the managerial and technical issues associated with their use. The Catalogue in this series is a comprehensive listing of all municipal microcomputer installations in the province of Ontario, together with information about hardware and software vendors. The Case Studies describes the experience of some larger municipalities that have installed microcomputer systems.

These publications will be re-issued or updated periodically to stay current with developments in microcomputers and their use in municipalities in Ontario.

Funding for the publications was provided under the Municipal Action '85 program.

The emphasis in all eight publications is on providing information that municipal decision-makers can put to practical use. Comments on their content and value are welcome. They should be forwarded to:

Ministry of Municipal Affairs and Housing
The Director
Municipal Management Policy Branch
11th Floor
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Toronto, Ontario
M5G 2E5
(416) 585-7201

MICROCOMPUTERS IN SMALL MUNICIPALITIES: A GUIDE

1 - INTRODUCTION

Microcomputers have turned the computer world of the past twenty years on its ear. They have assaulted the kingdom of the large "mainframe" computer, with its army of specialists, and are rapidly overtaking the domain of the minicomputer. Microcomputers have succeeded because, compared with the mainframes and the minicomputers, they are relatively inexpensive and compact, as well as being easier to operate.

Ontario's small municipalities are recognizing that microcomputers bring automation within their reach. A microcomputer makes it possible for a small municipality to have its own computer to handle those tasks that are carried out most effectively by a computer.

Getting to the stage of having an up-and-running microcomputer system requires careful planning. Only those people who have hands-on experience of using a microcomputer to do their work will be aware of the full implications. Such people are still comparatively rare - which is why this Guide has been produced. The information in it will save readers from having to re-invent the wheel.

A MICROCOMPUTER DEFINED

A microcomputer, for the purposes of this Guide, is a desktop machine that is powerful enough to be used by a small municipality's office staff to carry out management, administrative and operational tasks. "Home" computers and those designed mainly for playing games are excluded. The microcomputer on which this Guide concentrates will be used by only one person at a time. It will not be linked to another computer, i.e., it is a "standalone" microcomputer. Microcomputers that are linked to other computers are discussed in another Ministry publication, Microcomputers in Local Government: A Manual.

GOALS

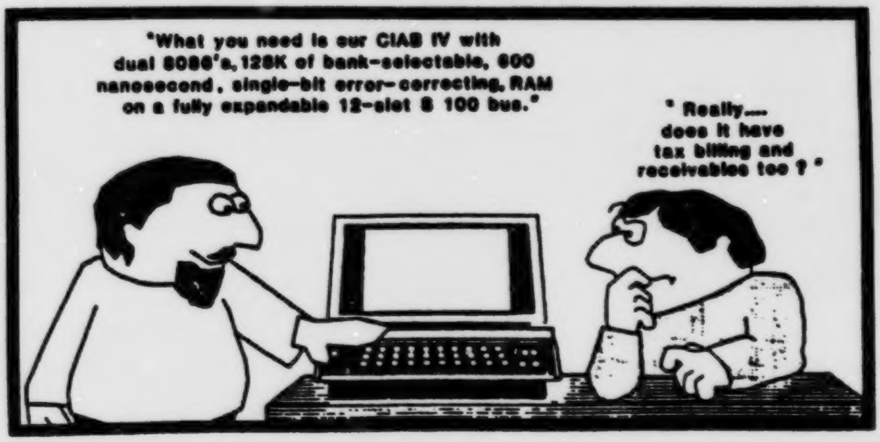
The goals of this Guide are to provide small municipalities, typically with three to seven continuous, full-time employees and populations of 5,000 or fewer, with:

- the information needed to make decisions about the practicality of a microcomputer for your particular municipality
- sufficient technical information to enable you to communicate your needs to vendors and to make informed choices
- advice on how to select, acquire, install and operate a microcomputer, and
- tools (worksheets, checklists, and sources of help) that you can use to plan for, evaluate, acquire, and install a microcomputer with the best possible chances of success. These tools are contained in the Workbook, a companion publication to this Guide.

Only you can decide whether your municipality needs a microcomputer, what it will be used for, and what kind to get. This Guide will be helpful if you are new to microcomputers or if you are new to their use in municipalities. As will be evident from the Guide's contents, detailed work and a big "upfront" effort are unavoidable if the microcomputer is to be a success. However, once you have used a microcomputer successfully, the chances are that you will wonder how you ever managed without it.

SCOPE

This Guide does not address how to operate the microcomputer, or how the microcomputer works inside (except in very general terms), or how to write programs. Instead, it raises the many questions that you as a manager in a municipality, or as someone responsible for municipal administration, need to consider. It will also help you and others in your municipality to jump the communications gap.


"What you need is our CIAS IV with dual 8086's,128K of bank-selectable, 600 nanosecond, single-bit error-correcting, RAM on a fully expandable 12-slot S 100 bus."
" Really— does it have tax billing and receivables too ? "

HOW TO USE THIS GUIDE AND WORKBOOK

For the convenience of readers, the information is presented in two volumes: this publication, called A Guide, and a second publication, called A Workbook. This Guide can be read by itself, or it can be read and used in conjunction with the Workbook.

This Guide

The main text is presented in Sections 2 through 9. Section 2 explains the basic concepts and components of a microcomputer system. Readers who are familiar with microcomputers can skim or simply skip over this section. Section 3 describes, in general terms, how microcomputers can be used. Section 4 looks at the practical issues to be considered when deciding whether to acquire a microcomputer for your municipality. Section 5 explains the steps in defining exactly what you want your municipal microcomputer to do. Section 6 deals with choosing a vendor and buying the microcomputer. Section 7 outlines the procedures for installing the microcomputer and commencing operations. Section 8 provides practical advice for ongoing operation. Finally, Section 9 takes a brief look at the future of microcomputers.

This Guide also contains three appendices:

- A - Glossary
- B - Sources of Information/Advice and Education/Training
- C - Trade Marks and Registered Names.

The Glossary, in Appendix A, lists "computer" words that appear in this Guide. Technical jargon has been kept to a minimum in the text, but it cannot be avoided entirely. If you encounter a word that is unfamiliar, please refer to the Glossary for an explanation.

Much of the information and training required in order to use your microcomputer system should be provided by the vendor(s) with whom you deal. You may feel a need for additional education and training, or information and advice. Appendix B points you to some possible sources. It also contains a bibliography of publications on microcomputers and local government practices.

The Workbook

The purpose of the Workbook is to provide tools that can be used to help with the tasks of planning, acquiring, installing and operating microcomputers. The Workbook contains detailed worksheets and checklists, together with instructions on how to use them. It generally follows the sequence of steps in this Guide.

Its contents are as follows:

- a checklist to help you in deciding whether a microcomputer is practical for your municipality
- the suggested topics for a report to council
- checklists of software requirements for the following applications:
    - general ledger
    - accounts payable
    - tax billing and receivables
    - word processing
- a method for calculating how much work your microcomputer will have to handle (volumes)
- a method for estimating the capacity the microcomputer equipment (hardware) must have in order to handle your planned workload
- a checklist of requirements for operating software and hardware
- lists for collecting information on costs
- checklists and questionnaires to be used when assessing vendors and their products.

The major steps in acquiring a microcomputer are summarized in Exhibit 1, overleaf. This summary of guidelines makes it easier to use these two publications when you embark on your journey to "microcomputerization". The steps that make up each of the five phases - planning for your microcomputer, defining and documenting your requirements, and selecting, implementing and operating your system - are shown. References are provided to the appropriate parts of both the Guide and the Workbook.

You may want to photocopy this exhibit and use it as a master checklist of the tasks to be carried out.

EXHIBIT I

SUMMARY OF GUIDELINES

PHASE 1

PLANNING FOR YOUR MICRO

	1. BECOME INFORMED ABOUT MICRO USES IN SMALL MUNICIPALITIES	2. DECIDE ON THE KIND OF HELP YOU MAY NEED	3. DRAW UP THE MICRO APPLICATIONS PLAN	4. DECIDE IF THESE APPLICATIONS AND A MICRO ARE PRACTICAL	5. INVESTIGATE ALTERNATIVES	6. REPORT TO COUNCIL
GUIDE AND WORKBOOK REFERENCE	G.3 - USES OF MICROCOMPUTERS G.9 - FUTURE TRENDS G.2 - WHAT A COMPUTER IS (OPTIONAL) G.APP. A - GLOSSARY	G.4 - GETTING STARTED G. APP B - HELP	G.3 - USES OF MICROCOMPUTERS G.EX. 2 - MUNICIPAL MICRO APPLICATIONS G 4 - GETTING STARTED	G.4 - GETTING STARTED G.EX.3 - EST. COSTS OF MICROCOMPUTING W. 2.1 - PRACTICALITY CHECKLIST	G.4 - GETTING STARTED G.EX.5 - COMPARISON OF ALTERNATIVES	G.4 - GETTING STARTED G.EX.4 - SAMPLE COST / BENEFIT ANALYSIS W.2.2 - REPORT TO COUNCIL

PHASE 2

DEFINING AND DOCUMENTING YOUR REQUIREMENTS

7. DEFINE AND DOCUMENT APPLICATIONS REQUIREMENTS	8. DETERMINE VOLUMES	9. ANALYSE SYSTEM CAPACITY NEEDS	10. DEFINE HARDWARE AND OPERATING SYSTEM NEEDS	11. PREPARE ADDITIONAL CHECKLISTS
G.5 - DEFINING YOUR REQUIREMENTS W. CHECKLISTS: - 3.1 - G/L - 3.2 - A/P - 3.3 - TAX BILL / REC. - 3.4 - WORD PROCESSING	G.5 - DEFINING YOUR REQUIREMENTS W.4.1 - VOLUME SURVEY	G.5 - DEFINING YOUR REQUIREMENTS W.4.2 - CAPACITY ANALYSIS	G.5 - DEFINING YOUR REQUIREMENTS W.5.1 - HARDWARE AND OP. SYSTEM REQ CHECKLIST	W.3.5 AND 3.6 - SOFTWARE CHECKLISTS W.5.2 AND 5.3 - HARDWARE CHECKLISTS W.6 - COSTS

PHASE 3

?

SELECTING YOUR SYSTEM

12. DECIDE ON A SELECTION APPROACH	13. IDENTIFY QUALIFIED VENDORS	14. CONTACT VENDORS TO EXPLAIN REQUIREMENTS	15. EVALUATE VENDORS' WRITTEN RESPONSES	16. SELECT BEST VENDOR AND INFORM COUNCIL	17. WITH COUNCIL APPROVAL, NEGOTIATE CONTRACT
G.6 - SELECTING THE VENDOR	G.6 - SELECTING THE VENDOR	G.6 - SELECTING THE VENDOR	G.6 - SELECTING THE VENDOR W.7 - VENDOR EVALUATION WORKSHEET W.7 - VENDOR EVALUATION SUMMARY	G.6 - SELECTING THE VENDOR	G.6 - SELECTING THE VENDOR

PHASE 4

IMPLEMENTING YOUR NEW SYSTEM

18. DRAW UP AN IMPLEMENTATION SCHEDULE	19. VERIFY REQUIREMENTS FIT	20. PREPARE SITE, ORDER SUPPLIES AND TRAINING MATERIALS	21. INSTALL MICRO AND COMPLETE BASIC TRAINING	22. IMPLEMENT FIRST APPLICATION	23. IMPLEMENT OTHER APPLICATIONS
G.7 - IMPLEMENTING YOUR MICRO SYSTEM G.EX. 6 - IMPLEMENTATION SCHEDULE	G.7 - IMPLEMENTING YOUR MICRO SYSTEM	G.7 - IMPLEMENTING YOUR MICRO SYSTEM	G.7 - IMPLEMENTING YOUR MICRO SYSTEM	G.7 - IMPLEMENTING YOUR MICRO SYSTEM	G.7 - IMPLEMENTING YOUR MICRO SYSTEM

ONGOING

OPERATING YOUR SYSTEM / FUTURE TRENDS

G.8 - OPERATING YOUR MICROCOMPUTER
G.9 - FUTURE TRENDS

LEGEND

G. - GUIDE SECTION
W. - WORKBOOK SECTION
G.EX - GUIDE EXHIBIT
G.APP. - GUIDE APPENDIX

2 - WHAT A COMPUTER SYSTEM IS AND HOW IT WORKS

This section is intended for those readers who are new to microcomputers. It describes the basic components and operations of a microcomputer system. If you are familiar with microcomputers, you could skim this section or skip it. Technical details are kept to a minimum: the intention is to provide a general understanding of some important elements. The Glossary in Appendix A will help if you need further explanation of particular terms.

You probably drive a car. Even if you don't understand how its engine works, that does not stop you from driving it. On the other hand, you must know what the gear shift and accelerator pedal do. And when it comes to buying a car, you need to know enough to choose one that will do what you want it to do. Similarly, it is necessary to have a general understanding of the basic parts and processes of a microcomputer system.

There are very few standards to which microcomputers conform. As a result, you cannot assume that a Brand X microcomputer will perform the same tasks as a Brand Y does, even if they happen to be the same size and equally powerful. In fact, Brand X's model UNO may not even do all of the things that its own sister model, the DUO, can do. Whether or not a microcomputer will live up to your expectations will be largely dependent on its capabilities, so you need to know enough to judge a microcomputer's capabilities.

The retail world of microcomputers is confusing. If you are thinking of recommending the purchase of a microcomputer to your council, you will want to know the right questions to ask the computer salesman. Many of these questions are provided in the Workbook. The concepts underlying the questions are explained in this section.

WHAT IS A COMPUTER?

A computer, in a word, is a tool. It is a machine that aids our memories by storing information (numbers, words, and facts) in its own memory. It carries out tasks that we want it to perform by moving information in and out of its memory and processing it in some way.

A computer's chief characteristics are these:

- it will do only what it is told to do
- it uses programs - sets of instructions written in computer language to make the computer carry out the tasks we want it to perform
- it carries out computations by means of arithmetic instructions (adding, subtracting, etc.) and logical instructions (shifting, comparing and testing the value of numbers and letters)
- it can change the order in which it carries out instructions
- it sends messages to and receives messages from input/output devices, i.e., equipment attached to it which enables you to communicate with the computer
- it carries out the same instructions over and over again, without error or complaint, and at high speed.

Its versatility, accuracy, and speed make the computer a unique tool. What makes the microcomputer special, compared with other kinds of computers, is its apparently low cost, its compactness, and its relative ease of use. You do not have to be a data processing professional to use a microcomputer.

THE THREE MAIN CLASSES OF COMPUTERS

This Guide is concerned with microcomputers. Nonetheless, it is useful to know where microcomputers fit into the universe of computers. Although the classes overlap, the main classes of general-purpose computers are mainframes, minicomputers and microcomputers.

Mainframes

Mainframes are computers with very large memories and sophisticated processing units that are used, for example, by banks and airlines, as well as by government departments. The Ministry's Municipal Analysis and Retrieval System (MARS) is on a mainframe. Mainframes are used for jobs that require very large amounts of information to be stored and retrieved (e.g., the assessment file for a large city), and for jobs that require a lot of information to be entered and manipulated in some way (e.g., the financial reports for a large school board.) Mainframes can be used simultaneously by many different users. They invariably require specialists to run them and cost $250,000 or more.

Minicomputers

Minicomputers are physically smaller than mainframes and have less memory and processing power. Minicomputers may cost anywhere from $20,000 to more than $500,000 and may require at least one full-time specialist (for the larger minicomputers) to install and run them. Many municipalities in the 5-25,000 population range have installed a minicomputer to handle all their complete accounting requirements, using ready-made programs designed for Ontario municipal government purposes. Generally speaking, the purchase price of the software ($20,000 to $50,000 or more) includes the cost of getting the programs installed and working on the computer. The existing accounting staff are trained to operate the system; specialist data processing staff are usually not employed.

Microcomputers

Microcomputers are the smallest computers; they may be divided into two categories:

- home microcomputers - intended for "non-business" purposes, that can be used for playing games and little else, costing from under $1,000 for the hardware and basic software.
- office microcomputers (sometimes called small business computers) - designed with the capacity to handle functional activities such as tax billing as well as acting as personal productivity tools when used for such purposes as word processing. Their cost is in the range of $1,000-$20,000.

The computer concepts, parts and processes described in the remainder of this section are, in essence, common to all computers.

BASIC ELEMENTS OF A MICROCOMPUTER SYSTEM

Strictly speaking, a microcomputer comprises only the "brain" (called the microprocessor) which executes the instructions, plus the memory in which information is stored. But in order for the microcomputer to carry out the tasks the user wants it to perform, the user must feed into it a program that contains instructions on how to carry out that task. The instructions must be written in a language the computer can understand. Also, the user needs a means of communicating information, or data, and instructions to the computer, and the computer needs a means of communicating to the user what it is doing, as well as the results of its efforts - hence the need for input/output devices.

Input/output devices and other equipment attached to the computer are referred to as peripherals, e.g., keyboard, printer. The computer itself, its peripherals, and the programs are referred to collectively as the computer system.

CHIPS, BITS AND BYTES

Chips are used for several different functions in the microcomputer. The most important is the chip that functions as the central processing unit (CPU), or the microprocessor.

The Microprocessor Chip

Smaller than a baby's thumbnail, the microprocessor chip consists of a silicon base supporting microscopically small electronic switches (known as gates) joined by "wires" etched from metal film. A single chip may contain about half a million switches. That number is growing all the time, and as it grows, the chip becomes increasingly powerful.

The switches on a chip, just like an electric light switch, can be in only one of two positions: on or off. If the switch is on, electric current can flow through it; if the switch is off, it can't. More than forty years ago, computer pioneers used switches to represent data: the "on" position corresponds with the digit 1 and the "off" position corresponds with 0. A high-voltage electrical pulse is used to signal 1 and a low-voltage pulse to signal 0. The principle of associating digits (1's and 0's) with the condition of being on (1) and off (0) underlies all electronic data processing.

Bits and Bytes

The letters, numbers and symbols (collectively referred to as characters) that we as human beings understand are translated into a code that computers can "understand", consisting of 1's and 0's. By combining 1's and 0's in different ways, we can represent whatever letters, numbers, and symbols we want to use. The use of 1's and 0's in this way resembles the use of dots and dashes to send messages in Morse code. A system that uses only two digits - a one and a zero - is called binary (contrast it with the decimal system, which uses ten digits). A bit, short for binary digit, represents the smallest piece of data (an on or off switch position) that the computer can store.

A code known as ASCII (American Standard Code for Information Interchange) has become a standard for microcomputers. ASCII uses a combination of seven 1's and 0's to represent a particular character. The character "A", for example, is coded as 1000001. An eighth digit, called a parity bit, is used for checking accuracy.

The ASCII codes for the letter "A" and the decimal numbers 1 and 2 are shown below:

ASCII BYTE (7 BITS)	REPRESENTS CHARACTER
1 0 0 0 0 0 1	A
0 0 0 0 0 0 1	1
0 0 0 0 0 1 0	2

Eight bits are used in most microcomputers to represent a character. Eight bits constitute a byte. For most purposes, a byte is the smallest piece of data on which the microcomputer operates. A byte can be thought of as the equivalent of a keystroke on a typewriter.

HARDWARE

THE CENTRAL PROCESSING UNIT (CPU)

The CPU, or microprocessor, is the most vital piece of hardware in a computer. It carries out, or executes, instructions which enable the computer to do the variety of tasks that users require.

The CPU collects signals from other parts of the computer system, acts on them according to arithmetic and logical instructions, and sends signals back.

Early microcomputer CPU's operated on eight bits of data, or one byte, at a time. The newer microcomputers have 16- or 32-bit microprocessors. Since these larger microprocessors "think about" and move data around in larger chunks, they are usually faster and can do more work than an 8-bit machine.

MEMORY AND MEMORY-RELATED DEVICES

The memory is the computer's storehouse for information. Its size, or capacity (how much it can hold), has a very important bearing on what a microcomputer can be used for - and therefore how useful it is. Memory devices are now most commonly produced as chips or in some magnetic form. The technology of computer memory is progressing rapidly and improvements are constantly being made.

A computer generally has three kinds of memory: permanent memory, called Read Only Memory, or ROM; temporary memory, called Random Access Memory, or RAM; and mass storage memory. Being produced in the form of chips, ROM and RAM can hold only limited amounts of information. This problem is overcome by using magnetic disks or tapes for mass storage of programs and data.

How Memory Size is Measured

The size of a microcomputer's memory - RAM, ROM or mass storage - is measured in bytes. Bytes are usually counted in thousands or millions. The units are:

kilobyte = K byte (KB) = 1,024 bytes
megabyte = M byte (MB) = 1,024 x 1,024 = 1,048,376 bytes

Thus a K byte is roughly equal to 1,000 bytes and an M byte is roughly one million bytes. Since one byte is needed to represent a character, 1 K byte of memory will hold only about 1,000 characters. 64 KB of memory will hold 65,536 characters. This may seem a lot, but an average page of text, for example, could easily contain 3,000 characters. Thus 64 KB of memory would store only about 22 pages of text.

ROM

Read Only Memory is used by the CPU. The switches on a ROM chip are permanently etched by the computer manufacturer. Thus, the CPU can read the data or instructions in ROM, but it cannot alter them. ROM stores the start-up and control routines that the CPU uses constantly. ROM is permanent in another sense, too: whether the computer is turned on or off, the contents of ROM do not disappear, i.e., ROM chips are "non-volatile".

RAM

Random access memory, often called the main memory, is the memory you will be concerned with when you are considering the size of memory your microcomputer will need, to do the work you want it to do. RAM allows instructions or data to be put into it, taken out, or simply read. The programs or data stored on disks, diskettes or magnetic tape are loaded into RAM. The CPU goes to RAM to get the instructions or data on which to operate. It can go directly to any location in RAM, which is why it is called random access memory. When the computer is finished the operation, it sends the data back to RAM. RAM can store any type of data or instructions, and is therefore very flexible. Being chip-based, it is also very fast.

The contents of most types of RAM are volatile: when the computer is turned off they disappear. Program instructions and data can

always be put back into RAM the next time you use the computer because they are stored on disks, diskettes or magnetic tape. However, the results of any processing the computer has done will be lost, unless they have been transferred out of RAM, to magnetic tape or disks, before the computer is turned off.

When the microcomputer is in use, RAM has to hold operating instructions, program instructions, and the data the program is working on. If the micro is to operate efficiently, its RAM must be large enough to hold a complete program, and the data to be processed by that program.

Office microcomputers need at least 64 K bytes of RAM. Many popular word processing packages require more than 64 KB, and some spreadsheet packages require at least 192 KB. New machines may have 512 KB or more of RAM.

Mass Storage Memory

The space available for storing data or instructions in RAM is limited. This problem is overcome by using mass storage devices that are physically separate from the computer. This kind of memory comes in the form of disks, diskettes and magnetic tape. All three are used for storing large amounts of data, as well as programs.

Disk technology was developed to overcome the chief drawback of magnetic tape: the fact it takes a long time for the computer to find the data it wants on a magnetic tape. (Access is sequential, not random, so the computer has to search the tape until it reaches the information it requires, instead of being able to go to that information directly.) Magnetic tape is still widely used for backup purposes, since it is much cheaper than disks.
Disks use a magnetic medium but take a physical form much like

that of a phonograph record, enabling information to be accessed randomly and quickly.

Disk Drive

A piece of equipment called the disk drive loads the program and data recorded on the disk into RAM. The disk drive has a read-write head mounted on an arm which can be positioned anywhere above the disk, like a stylus on a record player. The head reads and writes on concentric tracks. The density of tracks (the number of tracks per inch) determines how much data a disk can hold. The density may be single, double or quad. Disks may also be single- or double-sided. The latter require a disk drive with read-write heads that work on both the top and the bottom surface of the disk.

A motor in the disk drive rotates the disk, and another motor moves the read-write head into position. A program in RAM then accesses the disk and loads the data or instructions into RAM from the disk's memory. In this way, the microprocessor has very fast access to what it needs.

"Floppies"

Floppy disks, or diskettes, look much like 45-rpm phonograph records. They are now commonly available in two sizes: 8" ('floppies') and 5 1/4" ('mini-floppies'). They are not rigid but are housed in a stiff plastic envelope to protect them. A 5 1/4" floppy diskette can typically store from 120 to 400,000 bytes. An 8" floppy may store up to 1 million bytes, or 1 megabyte (1 MB). A new group of 'micro-floppies', between 3" and 3.9", is coming on the market. They have storage capacities as great or greater than those of the 5 1/4" mini-floppies, and are reported by the manufacturers to be much more reliable.

A floppy disk must be loaded into the microcomputer's disk drive unit when you want to use the data or programs stored on it. When you have finished using the floppy you take it out of the disk drive.

Hard Disks

Made of aluminum with an iron oxide magnetic surface, hard disks (often called Winchester disks) are, as their name suggests, rigid. They are becoming more widely used in microcomputers. A hard disk, unlike a floppy, cannot usually be removed from the microcomputer, although removable hard disks are now becoming available.

A hard disk stores far more than a floppy disk of the same size - typically between 5 and 20 million bytes (5-20 MB). It is much faster at transferring data to the RAM. It is also much more expensive than a floppy disk, but the price is coming down.

Mass storage devices are being improved constantly. The faster, cheaper, more reliable and more compact they become, the more valuable and versatile microcomputers will become.

INPUT/OUTPUT DEVICES

The equipment enabling us to communicate with computers and vice versa is, of course, more familiar than the computer's internal hardware. The input/output devices are what we see and use - the keyboard, the CRT (cathode ray tube), and the printer. Disk drives, discussed above, are also input/output devices. There is another device, too - the modem, which enables one computer to communicate with another via telephone lines.

The Keyboard

The computer's keyboard resembles the keyboard of a typewriter, but it has additional, special-purpose keys. The keyboard may be a separate unit, or it may be built into the housing of the microcomputer. By depressing a key, you send a coded signal to the computer, thus gaining access to its CPU and memory. You can type, or key in, data (letters, numbers or symbols) as well as instructions, and they will appear on the screen of the CRT. You can also choose particular programs from menus (lists of different functions displayed on the screen) by keying in the appropriate response.

The CRT

The cathode ray tube (CRT) is the part of the computer that looks like your television set. The CRT is also called a VDT (video display terminal) or a monitor. Like the keyboard, it may be a separate unit, or it may be built as part of a unit which contains the keyboard and the microprocessor. Its screen displays data or instructions that you are entering, layouts for the data, the output resulting from the computer's efforts, or messages such as error messages and prompts to help you do the right thing.

The computer CRT produces a sharper picture than the CRT used in television sets. Displays may be black on white, green on black, or amber on black. Display screens are usually 80 characters wide and 24 rows long. With the right kind of software, it can display charts in graphic form, engineering drawings and cartoons. Just as with the other hardware components, display technology is being improved all the time.

Printers

A printer is a robot typist that produces the computer output on paper. The two basic types of printer are the impact, or "letter-quality", printer and the dot-matrix printer. A letter-quality printer prints a character - a whole letter, number or symbol - as a fully formed impression in a single stroke, exactly as a character is printed by a typewriter. But instead of a letter hammer or type ball that typewriters use, the printer uses a print wheel (often called a daisy wheel) or a thimble.

Letter-quality printers are slow, printing about 30 to 55 characters per second (cps). They are also expensive to buy and to operate. However, their printing looks better than that produced by a dot matrix printer. (This Guide was printed using a letter-quality printer.)

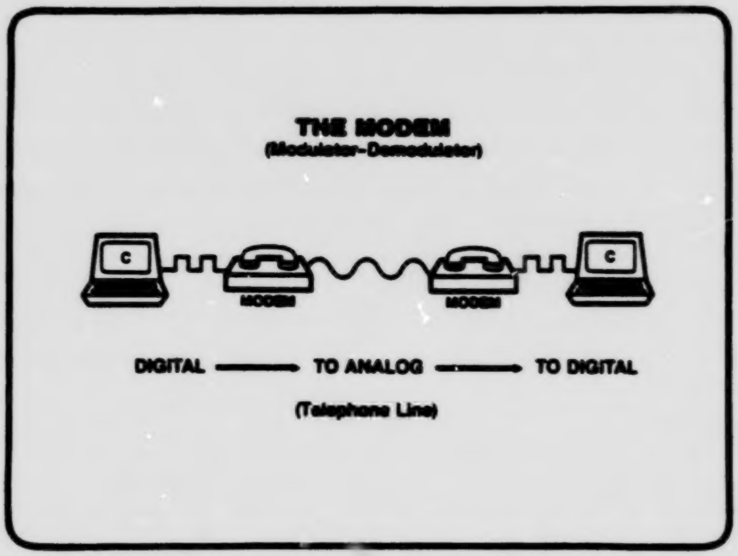
The dot matrix printer deposits a pattern of dots on the paper, in the shape of a character. These printers are three to eight times faster than letter-quality printers and are less expensive to buy and to operate. The quality of their output can be improved to resemble letter-quality printing, but the means of doing so slows down the printer's speed. They do a better job than letter-quality printers of producing graphics, and they tend to require less servicing.

COMMUNICATIONS

A microcomputer is a powerful tool. It can be employed for a great variety of purposes using no more than the programs you choose and the numbers, words or facts (data) that you provide. Such a microcomputer system is self-sufficient, and it can operate without being linked to any other computer, i.e., it is a standalone system. However, one of the real strengths of a microcomputer is that it can be linked to other computers, or even to other office equipment. Linking one computer to another enables them to communicate. They can pass messages (electronic mail) and information (from other computers' data bases) and can share processing tasks (distributed networks). Whether or not you decide to link your microcomputer to another computer depends on what you want to use the microcomputer for.

Modems

One way of linking computers is by means of a modem (modulator/demodulator). A modem is a device that allows data to be sent via telephone lines to another computer. It converts the computer's digital signals to analog signals that the telephone lines use, so that the telephone can transmit messages to the receiving computer's modem. Here is a diagram showing the connections.


THE MODEM
(Modulator-Demodulator)
C
MODEM
MODEM
C
DIGITAL → TO ANALOG → TO DIGITAL
(Telephone Line)

SOFTWARE

Besides the hardware, you have to obtain software. "Software" refers to the programs written to run on the hardware, that tell the computer what to do. These programs are generally stored on disks. They are loaded into the computer RAM, where the CPU can access the instructions. The computer will not function without software. Software can be divided into two broad categories: operating software and applications software.

Operating software is the collective name for the class of programs that control the operations of the computer. Applications software is the collective name for the class of programs that apply the computer to your needs, e.g., accounting programs, word processing programs, etc.

OPERATING SOFTWARE

Many of the things a computer does that seem so clever are only possible because the computer manufacturer has built in some very complex programs - the operating software. These programs control the execution of other programs, as well as the internal functioning of the computer.

There are three main types of operating software:

- operating systems
- assemblers, compilers, and interpreters
- utility programs.

1. Operating Systems. The most widely used microcomputer operating systems, like much else in the computer world, are known by their initials - CP/M (Control Program for Microprocessors), and DOS (Disk Operating System) which comes in various versions for use with different makes of microprocessors. CP/M-80 has become virtually the standard operating system for 8-bit microprocessors and DOS in its various forms (MS-DOS, PC-DOS) the standard for the 16-bit microprocessors. The UNIX operating system and its derivatives (e.g., XENIX) seems to be becoming the standard for 32-bit microprocessors.

An operating system is a hard-working housekeeper. Here are some of the things it does:

- manages the computer's hardware resources (e.g., when the printer prints or when the disk reads)

- controls how the hardware works, (e.g., how to access information on disk)
- monitors the status and performance of both the hardware and the user's application programs
- controls the allocation of space, saves, retrieves and keeps track of the files, and oversees disk and main memory storage.

Operating systems reside in the microcomputer's ROM and the beginning tracks of a disk or a floppy disk.

It is necessary to know what operating system a microcomputer uses. The programs that you want to use to carry out tasks (called applications software or application programs) must be compatible with the microcomputer's operating system. There is a simple reason why they must fit. The application programs make use of operating system commands. If the application program uses one operating system's commands, and your microcomputer has a different operating system, the application program will be unable to run on your microcomputer.

2. Assemblers - Compilers. A computer understands only machine language, which consists of binary (or octal, or hexadecimal) numbers and is very cumbersome. If we speak English and the machine understands only numbers, how are we to communicate? Programmers get around the problem by writing application programs in a computer programming language, which is somewhat like English. This language has then to be converted into machine language so that the computer can understand the program's instructions.

The software that does the translation is called an assembler, compiler or interpreter. One or other of these "translation" programs will be necessary, depending on the language used for the application programs. COBOL and FORTRAN are languages that use a compiler; different versions of BASIC may use either an interpreter or a compiler.

3. Utility Programs. Utility programs are programs that assist in the computer's data processing operations. They instruct the computer to carry out routine chores, such as sorting data or recovering from errors or communicating to other computers. In some cases, the manufacturer supplies the utility programs. In other cases, an independent programmer writes the programs, and they may subsequently be stored as part of the operating software. Thus, some utility programs can be bought separately.

APPLICATIONS SOFTWARE

With its operating software activated, the computer is ready and able to do something, but you have to tell it what you want it to do. This is where applications software comes in. Applications software refers to computer programs that instruct the computer to carry out specific tasks, e.g., print water bills, or post the general ledger. They are produced by independent suppliers as well as by computer manufacturers. You choose the packages that you want according to what you want the computer to do. Programs may also be custom written to meet the specific needs of a particular user.

Applications software is written in one of several computer languages, the most common being BASIC, PASCAL, COBOL, RPG and FORTRAN. These languages are called high-level languages because a single instruction written in one of them is translated by the computer into several instructions in machine language, which the computer then executes. BASIC is the most widely used language for microcomputer programs.

HOW DO YOU MAKE THE COMPUTER WORK?

What do you do to make the computer work? Assuming that the microcomputer does not have a hard disk, you put a diskette which has the operating system on it into the disk drive and turn the microcomputer on. The machine loads the operating system into RAM - a procedure known as "booting". Most commercially available application programs are designed to have the disk operating system added to the same disk that holds the application program. The system can then easily be booted by simply turning the machine on.

The computer will then wait for you to key in some data - either numbers, or words - that you want the computer to process in accordance with the instructions contained in the loaded program. Or it will show a menu, from which you choose the function you want.

The data you key in will appear on the screen. The computer does the necessary processing - storing and retrieving data as it does so - and displays the results of its efforts on the screen. You can then instruct it to print out the results on your printer if the program provides for printed output, or you can store the results on a diskette.

The detailed instructions for operating a microcomputer are contained in manuals produced by the microcomputer manufacturer. Similarly, manuals are written by software producers explaining how to use their programs.

3 - THE USES OF MICROCOMPUTERS: IS THERE A MICROCOMPUTER IN YOUR MUNICIPALITY'S FUTURE?

Will a microcomputer be a valuable asset to your municipality? In order to decide, you obviously need to have an idea of what a microcomputer can do and how it can be used. You can then consider whether your municipality can make practical and cost-effective use of a microcomputer.

THE EVOLUTION OF MICROCOMPUTERS

There are two quite distinct ways in which microcomputers can be used in organizations: they can be used as a productivity tool by individuals, and they can be used as a central resource, to carry out "corporate" functions, just as large computers have traditionally been used in large organizations. It is useful to know how microcomputers have evolved in order to understand their current and their likely future use.

Large, general-purpose computers (mainframes) have been in wide use since the 1960's. They were, and are still, very expensive. The equipment manufacturers produce not only the equipment but also the complicated programs (sets of instructions) required to make the machines carry out tasks. Computer specialists of various kinds - such as programmers, analysts, data entry clerks, etc. - are needed to make these large systems work. Since the systems and personnel are so expensive, large computers are used primarily for corporate, or organization-wide functions that are vital to the organization as a whole - accounting, inventory control, and the like - and for storing very large amounts of data. Some minicomputers, although they are generally smaller and less expensive than mainframes, need the same specialist resources.

In 1971, an American engineer invented the microprocessor, a computer brain on a chip the size of a baby's fingernail. His invention made it possible to miniaturize the components of computers. Manufacturers seized on this development. One result has been the microcomputer - a small, fast, comparatively inexpensive machine that can do many of the same things as its big brothers.

Until 1979 microcomputers were used mainly by computer hobbyists, and technical and scientific users who wrote their own programs. Then came a real breakthrough. Computer programs, referred to as "generic packages" in this Guide, appeared in the marketplace. These programs could be used for administrative and management purposes by people who were not highly trained in computer programming. Such "ready-to-go" programs allow non-specialists to use computers.

It is necessary to stop here and explain some important terms.

PACKAGES, GENERIC PACKAGES AND FUNCTIONAL PACKAGES DEFINED

A package refers to an application program that is sold as a complete, self-contained unit, comprising a thoroughly tested program or series of programs ready for use as well as a comprehensive manual explaining how to use the package. The program instructs the computer to carry out the tasks that the user wants done. A program sold as a package should be usable by the purchaser without major modifications being necessary.

Program packages, (also called software packages or application packages) can be divided into two major types: generic packages, and functional packages (as they are called in this Guide). The computer literature uses a variety of terms to refer to generic packages and functional packages. To avoid confusion, these terms are used consistently in this Guide.

Generic packages are packaged programs that can be used by anyone in any organization - regardless of industry, or size of organization, or the experience of the computer user. Also, the tasks that generic programs perform are not restricted to any particular part of an organization. For example, the production of documents (letters, memos, reports, etc.) occurs right across an organization. So a generic package such as a word processing package could be useful to anyone who has to produce letters or reports. These packages enable individuals to improve their own productivity in carrying out their own work. A microcomputer used primarily to run generic packages is thus being used as a productivity tool.

In contrast with generic packages, a functional package refers to a series of computer programs that perform the tasks connected with a particular organizational function - for example, accounting, or tax billing or payroll. (All of these are corporate functions.) A microcomputer used primarily to run such functional packages is being used as a "central" computer, in the same way that larger municipalities use mainframes and minicomputers as central computers.

These functional packages also differ from generic packages in another important respect. They are usually designed for a particular industry. Accounting practices among different industries or sectors of the economy vary quite a lot. An accounting package designed for commercial business therefore probably won't meet the requirements of local government without being heavily modified. The characteristics of generic and functional packages are summarized in Table 1.

TABLE I

GENERIC AND FUNCTIONAL PACKAGES

TYPE OF PACKAGE	USERS	PURPOSE	EXAMPLES
GENERIC	ANY ORGANIZATION OR ANY INDIVIDUAL	INCREASE INDIVIDUAL PRODUCTIVITY	WORD PROCESSING SPREADSHEETS, DATA BASE, ETC.
FUNCTIONAL	ORGANIZATIONS IN A PARTICULAR SECTOR, e.g. LOCAL GOVERNMENT	CARRY OUT ORGANIZATIONAL FUNCTIONS	TAX BILLING, GENERAL LEDGER, ACCOUNTS PAYABLE, ETC.

THE MICROCOMPUTER AS A PRODUCTIVITY TOOL

It was the development of generic packages that led to the explosive growth in the use of microcomputers in organizations. Microcomputers no longer required their users to have programming expertise. The three best-known generic packages are probably VisiCalc, a spreadsheet package, WordStar, a word processing package, and Lotus 1-2-3.

Spreadsheet Packages

An electronic spreadsheet package turns the microcomputer's screen into the equivalent of a very large sheet of paper with columns and rows, like the spreadsheets used for accounting or bookkeeping. These packages make it easier to produce a budget, for example, than using traditional manual methods. You tell the microcomputer what numbers to work with, what calculations to perform, and when to perform them. If you want to change one of the numbers to see how it will affect the rest of the budget, the computer automatically changes all the related numbers.

Word Processing Packages

Word processing packages turn the microcomputer into a typewriter that processes words electronically. These packages not only enable the microcomputer to produce your letters, reports, minutes and so on, but they also allow you to rearrange paragraphs, change the wording, and re-format the appearance of the text, all automatically. Some word processing packages can compile lists, create indexes and even check spelling.

Besides spreadsheet and word processing packages, there are three other main types of generic packages: i) data base utilities, report generators, file managers and inquiry packages; ii) graphics; and iii) communications.

Data Base Utilities, Report Generators, File Managers and Inquiry Packages

These packages enable you to set up computer files, search the file contents quickly, display information, update or correct it, rearrange it in a different order, and print it in report form. You have immediate access to all the stored information.

Graphics

Graphics programs convert numbers into pictorial form - pie charts, bar graphs, and so on. The "pictures" are often much easier to grasp than a table of numbers. They may be displayed on the CRT or printed out, or both. Graphics programs require a specially equipped dot matrix printer or a plotter.

Communications

Communications packages enable computers to communicate with each other over telephone lines via a modem. The linking of one computer to another makes it possible to send and receive information.

Integrated Packages

Packages are also available that combine some of the functions described above. An "integrated" package might combine a spreadsheet, a graphics program, and a data base utility, e.g., Lotus 1-2-3.

MUNICIPAL USES OF GENERIC PACKAGES

Small municipalities find that word processing, spreadsheets and data base packages are the most useful generic packages. In addition to increasing individual productivity, they can be used to increase the efficiency of managing most administrative activities. A file management package, for example, enables you to retrieve information and draw up lists or indexes for by-laws, license renewals, allotment of cemetery plots - in fact, it can help you make better use, more easily, of all the information recorded in your computer.

THE MICROCOMPUTER AS A "CENTRAL" COMPUTER IN SMALL MUNICIPALITIES

Microcomputers are now sufficiently powerful to be used by small municipalities as "central" computers to carry out corporate functions that are critical to the organization, such as processing the general ledger and tax billing. The reduction in their price and size, together with the availability of packaged programs, means that even very small municipalities can afford to buy a microcomputer and use it as a central resource. A microcomputer used in this way will have a much wider impact on municipal administration than a microcomputer used by one or two individuals to do their own work in a more productive way. The implications, including the risks of using the microcomputer as a central computer, are discussed in Section 4.

Many small municipalities are interested in acquiring a microcomputer to carry out their accounting and tax billing functions. Since most microcomputers are capable of handling these and other central functions, the equipment is not an issue. The real issue is whether packages exist that meet the specific needs of small Ontario municipalities. If a municipality intends to implement a functional package, it requires one that is designed to meet municipal needs. An accounting package designed for general business purposes won't do. For example, a tax bill shows the roll number, mill rate, assessed value, school support, and number of installments and their dates. These items are not handled by most commercial billing and receivable packages. To be useful, functional packages - unlike generic packages - must be specifically designed for municipal government.

Furthermore, when you are in the market for a microcomputer, you want packages capable of running on a microcomputer. A municipal accounting package written to run on a mainframe or a minicomputer may not run on a microcomputer without extensive modifications. However, a few minicomputer programs have already been adapted for running on microcomputers.

At present, only a handful of vendors offer functional packages which are specifically designed for municipalities and which run on microcomputers. This is a new field. There are likely to be more vendors and packages in the future.

A MULTI-PURPOSE MICROCOMPUTER

If you decide that your municipality should use a microcomputer as a central computer, that will not prevent you from using the microcomputer to do word processing or to run some other generic package. But using the microcomputer to run both functional and generic packages has some practical implications.

Because many microcomputers can carry out only one process at a time - either inputting (entering words or numbers) or processing, or outputting (printing) - conflicts about availability may arise. For instance, during peak periods when tax bills are being processed, the microcomputer may not be available for word processing. Also, for letters and other correspondence, you need a high-quality printer, which is both slower and more expensive than the lower-quality printers considered adequate for most functional output. In addition, there is a tendency to accumulate word-processed documents on the system, with the result that more storage becomes necessary.

In short, if you are thinking of using a microcomputer to run both functional and generic packages, it is wise to give the functional packages top priority. Generic packages should be used only when they will not interfere with the microcomputer's main job and their input volumes are not excessive.

Some of the municipal tasks that a microcomputer can carry out are listed in Exhibit 2, together with the type of software - functional or generic - that is needed. The list is by no means exhaustive. Most people find that once a microcomputer system is up and running, new uses emerge that were not apparent in their pre-micro days. The Catalogue (a companion publication to this Guide) details the uses to which microcomputers are being put by small Ontario municipalities.

BENEFITS OF USING A MICROCOMPUTER

The benefits gained from using a microcomputer to run generic software differ somewhat from the benefits gained from running functional software. By using the microcomputer for such tasks as word processing or financial planning, you are likely to achieve:

EXHIBIT 2

MUNICIPAL MICRO APPLICATIONS

MUNICIPAL TASK	SOFTWARE TYPE			
	FUNCTIONAL	GENERIC		
	(FCN)	WP*	SS*	DB*
ACCOUNTING AND FINANCE				
1. Tax Billing and Receivables	FCN			
2. Hydro and Water Billing and Receivables	FCN			
3. General Ledger and Financial Reporting	FCN			
4. Accounts Payable and Encumbrance Accounting	FCN			
5. Expense Reports	FCN		SS	
6. Fixed Assets	FCN	WP	SS	DB
7. Capital Projects	FCN	WP	SS	DB
8. Project Estimating			SS	
9. Budget Preparation and Revenue Forecasting	FCN		SS	
10. Lease vs. Buy Analysis			SS	
11. Purchase Orders	FCN	WP		
12. Cash Flow Forecasting	FCN		SS	
13. Payroll	FCN			
14. Personnel Records	FCN	WP		
ADMINISTRATIVE SERVICES				
1. Letters, Memos, Reports		WP		
2. Bylaws, Contracts, Minutes, Procedure Manuals		WP		
3. Mailing Labels	FCN	WP		DB
4. File Indexes		WP		DB
5. Lists - Employees, Vendors, Registration Records, Cemetery Plots, Capital Projects, Etc.		WP		DB
6. Registrations - License Renewals, Building Inspections, Etc.		WP		DB
PUBLIC WORKS AND OTHER				
1. Capital Equipment Inventory	FCN	WP	SS	DB
2. Maintenance Management	FCN	WP	SS	DB
3. Communications to External Computers or Computer Vendors		Communications Package		

* WP = Word Processing; SS = Spreadsheet; DB = Data Base

- Improved productivity on the part of individuals using the microcomputer. (This does not normally mean that staff or managers are displaced when they use a microcomputer - merely that they can do more work in a given period of time. Overtime may be reduced.)
- Higher-quality results (evident from a higher degree of accuracy, more detail or a more professional appearance).
- Improved information for decision-making (evident from more sophisticated analysis of information or from more rapidly and more easily produced reports).

Using a microcomputer to do some or all of your municipality's accounting can bring these benefits:

- displacement or avoidance of current equipment costs (or service costs)
- improved cash flow through faster billing procedures and timely, up-to-date information on arrears
- tighter control of expenditures through up-to-date, readily accessible financial information and improved controls over disbursements
- improved office productivity because tasks previously performed manually are automated and because methods become more standardized. Less overtime and a reduced need for part-time staff may result
- faster and easier responses to queries from the public, council, staff, and provincial and federal government authorities. (The computer, rather than the staff, does the necessary searching through files and compiling of information.)*
- overall, improved management since the computer can readily produce information for planning, control, decision-making and other management purposes.*
- reduced dependence on particular individuals (staff turnover will not cause the system to collapse)
- possibly, reduced audit costs - or at least they may not go up by much. A well-designed financial system can improve the productivity of auditors.

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*These two benefits may also be gained from generic packages, depending on how you use them.

There is little doubt that municipalities can benefit from using microcomputers. The benefits, however, are not automatic and are usually achieved only after becoming thoroughly familiar with the microcomputer system and equipment.

PLANNING FOR YOUR MUNICIPAL MICRO

As a municipal decision-maker, only you can decide, given your municipality's particular circumstances, whether a microcomputer is practical. It is also necessary to decide what functions or tasks you want the microcomputer to do for your municipality and when: now, a year from now, or three to five years from now.

In order to arrive at realistic decisions, each application (the set of tasks that you want to put on the computer) needs to be considered from three points of view: operational, technical and economic. The purpose of this preliminary planning stage is to decide whether a microcomputer is a practical solution.
After the decision has been made about what to computerize and when it will be done, a detailed definition of each application is needed. This stage is called the requirements definition.
Finally, you are ready to talk to experienced systems vendors.
The next three sections deal with:

- preliminary planning and investigation
- defining the requirements
- selecting the vendor.

4 - GETTING STARTED

Some advertisements claim that you can buy, install and use a microcomputer without any previous data processing experience. This claim may be true if the microcomputer is used strictly for running generic packages, such as word processing or spreadsheets. However, with functional software, such as an integrated municipal accounting system, the issues are complex, detailed and unique to the individual municipality. (For example, what assessment information will you maintain in your tax billing system, and how will this information be updated?) A successfully automated accounting system will require:

- experienced, objective advice in the planning, acquisition, and implementation stages
- an experienced vendor who can offer proven municipal software.

Experience is an important word in this Guide. In connection with microcomputers, experience means familiarity with using small computers (preferably microcomputers) in an organization, as well as experience with a particular application (e.g., tax billing), gained either through having installed or having operated that application.

Before getting into planning, it is worth considering the issue of experienced assistance.

WHERE TO GET EXPERIENCED ASSISTANCE

It is essential for the first-time user who wants to use the microcomputer to run functional packages such as those for municipal accounting to have access to people who understand the use of microcomputers in municipal government. There are several sources of assistance, starting with the Ministry's field office personnel. (A list of field offices appears at the end of this publication.)

Some municipalities have established a computer advisory committee. Members have included councillors, officials from neighbouring municipalities that are using small computers, members of the Municipal Information Systems Association (MISA), staff of provincial ministries or other government agencies, and citizens at large - data processing professionals, businessmen who use microcomputers, or computer science educators. Even if such people cannot afford the time to sit on a committee, they could still be valuable sources of information.

If a computer committee cannot be set up, the first-time user will have to obtain detailed advice and assistance from the vendors from whom the hardware and software is purchased. It then becomes imperative to find an experienced systems vendor who is able to provide the support that you will need.

Another source of help could be a municipality, similar in size, that has already computerized the application you are considering. If no municipality has put the application you are considering on a microcomputer, that may be a signal to the first-time user to reconsider the application.

It may be worth hiring a consultant* if you feel the need for an opinion other than the vendor's, and cannot find any local source of experienced advice. Anyone you hire as a consultant should be a professional who not only knows microcomputers but who also understands their uses in municipalities. A computer whiz kid will not fill the bill.

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*A Ministry of Municipal Affairs and Housing publication, called Getting More for Consulting Dollars: A Guide for Municipalities in Ontario, is useful reading. See the Bibliography on p. 137.

Whatever help you get, remember that:

OM = DIY

or, installing an Office Microcomputer means Doing It Yourself, to a large extent.

Now, back to the first stage: preliminary planning. If you were considering building a house, you would probably consider the financing, location, total number of rooms, and so on before getting into the detailed planning of the floor layout, type of carpeting, etc. So it is with planning for microcomputers. The bigger issues need to be considered before getting into the details.

OBJECTIVES OF PRELIMINARY PLANNING

1. Identify the implications of proceeding with the computer project.
2. Assess alternatives to computerization.
3. Establish realistic expectations and objectives for the project.
4. Obtain council approval to proceed with the project before a lot of time and money has been spent.

Find out how deep the water is before jumping in. Exhibit 3 gives an idea of just how deep the water could be, considering only the costs and not the potential risks. Very detailed work is necessary if the installation of a microcomputer is to be successful. The preliminary planning stage should cover the operational, technical, and economic issues associated with the proposed computer investment. Upon its completion, council should be in a position to make a firm decision to proceed (or not to proceed) with acquiring a microcomputer.

EXHIBIT 3

ESTIMATED* COSTS OF MICROCOMPUTING

1. INITIAL (ONE-TIME) COSTS	COST
1.1 SOFTWARE (Packages or Custom Programs)	$ 5 - 20,000
1.2 HARDWARE	10 - 20,000
1.3 MISCELLANEOUS (Supplies, Training, Fixtures, File Conversion)	5 - 10,000
1.4 COSTS TO RUN PARALLEL SYSTEMS	5 - 10,000
1 - TOTAL INITIAL COSTS	$ 25 - 60,000
2. ANNUAL OPERATING COSTS	
2.1 MAINTENANCE (Hardware / Software)	2 - 3,000
2.2 MISCELLANEOUS (Supplies, Etc.)	1 - 3,000
2.3 ENHANCEMENTS AND TRAINING	1 - 4,000
2 - TOTAL ANNUAL OPERATING COST	$ 4 - 10,000
- TOTAL FIVE YEAR OPERATING COST = 5 YEARS X $ (4 TO 10,000)	$ 20 - 50,000
3. TOTAL INVESTMENT (OVER 5 YEARS)	
1. TOTAL INITIAL COSTS	$ 25 - 60,000
2. TOTAL FIVE-YEAR OPERATING COSTS	$ 20 - 50,000
3 - TOTAL FIVE-YEAR INVESTMENT	$ 45 - 110,000

***ASSUMPTIONS**

1. BASED ON A SINGLE MICRO RUNNING TAX BILLING, RECEIVABLES, GENERAL LEDGER, ACCOUNTS PAYABLE AND A WORD PROCESSING PACKAGE.

CONCLUSION

OVER FIVE YEARS, A $ 10,000 MICRO COULD COMMIT YOUR MUNICIPALITY TO SPENDING OVER $ 100,000 ON DATA PROCESSING.

STEPS

By following steps 1-4 below, you will produce a microcomputer applications plan. Steps 5, 6 and 7 take you through the operational, technical and economic issues. Step 8 looks at alternatives to the microcomputer. Step 9 deals with reporting to council.

1. IDENTIFY APPLICATIONS

If you have been thinking about acquiring a microcomputer for your municipality, you already have a general idea of what you want to use it for. To narrow the possibilities, it is worth asking some questions about the practices and procedures now being used in your office:

- What are the strengths and weaknesses of your present procedures?
- Which procedures have the highest volume and process the same type of information repeatedly (e.g., tax revenue information which is used in billing, receivables and the general ledger)?
- Which procedures most need improving?
- Which activities are the most important to the administration of your municipality?
- Which activities generate revenues? Which activities generate costs?
- Are there activities which could be improved by greater timeliness, and accuracy, or could clerical resources be reduced?

Beyond the work that you are doing now, are there functions that you should carry out (or services you should provide) that are possible only if you buy a computer - for example, producing reports that cannot be produced now because there isn't time to do so? How important are these functions and services? Has council asked for information that cannot presently be provided?

These kinds of questions will help to provide a clearer picture of where and how a microcomputer could be useful in your municipality.

2. CONSIDER BENEFITS AND RISKS

Considering not only the benefits but also the risks at this early stage can save a lot of grief. For example, if you decide to computerize your tax billing and receivable system, your municipality stands to gain financial benefits from collecting taxes faster or at shorter intervals, thus improving cash flow. On the other hand, if the new system does not work properly, every taxpayer in your municipality may be affected, and you could wind up with serious problems.

You will naturally want your first efforts at in-house computerization to be successful. Failure may result in council vetoing any further attempts, or in you and your staff losing confidence in the project. Depending on your circumstances then, it may be wise to give priority to a fairly simple application - say, accounts payable - and to wait until you have gained experience with it before attempting any other accounting applications. Or you could start by learning how to use a generic package such as a word processing package, so that you can produce visible results quickly.

3. DEFINE GOALS AND PRIORITIES

It should be possible to set some specific goals that computerizing your chosen applications will achieve. What improvements do you want to see? One objective could be to reduce arrears by 10%. Or you could aim at avoiding hiring additional staff during peak processing periods. These kinds of objectives will provide the justification for buying a microcomputer in the first place, and can be used later to measure your success.

4. DRAW UP A MICROCOMPUTER APPLICATIONS PLAN

Once the likely applications have been identified, their priority must be decided on. What functions do you want to computerize now, in a year from now, and in three to five years from now? Your decisions about applications and their priority constitute your microcomputer applications plan.

It is important to plan three to five years ahead. Otherwise, there is a strong possibility you will end up buying the wrong machine - one that is either too small and can't be expanded to handle the extra workload, or one that cannot run the software packages you will need in the future.

Wanting to automate some of your municipality's workload is one thing. Whether it is practical to do so is quite another. Once you have decided what you would like to computerize and when, it's time to look at the practicality of doing so. It is also useful to obtain a general idea of the type, size and probable cost of a computer system that will handle the proposed applications, and the potential savings. You should also consider alternative ways of achieving your objectives before making a definite commitment to go with a microcomputer.

5. CONSIDER THE OPERATIONAL ISSUES

The first question to weigh is whether a microcomputer could be successfully installed in your municipal office. This operational assessment can be performed by reviewing each of the planned applications using the questions listed in Section 2.1 of the Workbook.

The main purpose of the operational assessment is to find out whether the staff have the necessary experience and attitudes to choose and use microcomputer systems successfully. The answers to these questions give you an idea of the risks. For example, if you cannot identify a suitable staff member who can be trained as an operator, and who can type, you are facing a big obstacle. These kinds of operational roadblocks should be discussed with council and staff.

6. INVESTIGATE THE TECHNICAL ISSUES

If you are planning to put any part of your municipal accounting on a microcomputer, the most crucial technical issue is this:

> IS THERE A PROVEN PACKAGE DESIGNED FOR MUNICIPAL USE THAT WILL RUN ON MICROCOMPUTERS ?

Hardware - the microcomputer equipment - should not even be considered until this question has been answered. The questions that will help you assess the technical practicality of using a microcomputer are listed in Section 2.1 of the Workbook. If the answer to any question is no, experienced assistance may be needed during some or all phases of planning and implementation.

6.1 Find Out About Applications Software

There are basically two ways of obtaining applications software: buying packages, or writing "custom" programs to meet your needs and your needs alone. You and your staff can write the custom programs or you can hire someone else to do it for you.

> THE BEST ADVICE IS STRAIGHTFORWARD: LOOK FOR A PACKAGE. FIRST-TIME USERS SHOULD NOT GET INTO CUSTOM PROGRAMMING. IT IS EXPENSIVE, RISKY AND PROBABLY A WASTE OF TIME.

6.1.1 What to Look for in a Functional Package

Besides being designed for municipal use and capable of being run on a microcomputer, a functional package should be proven. Look for a package that has been successfully installed by at least two municipalities. If a package has not been successfully installed at least twice, it cannot be considered a proven package. Anything less may or may not work satisfactorily for you because it was designed to satisfy the particular needs of one user. Or it may be a prototype that is untested in a real situation. As pointed out earlier, there are very few proven, functional packages available now, but more will come.

If you are a first-time user, it is strongly suggested that you do not recommend any application to council for which you cannot find a proven package. The Catalogue (another publication in this series) the Ministry staff and MISA members are all excellent sources of information regarding functional packages, who is using them and who sells them.

Be aware that even proven packages will not be 100% perfect. Because local government use of microcomputers is new, functional packages are not yet refined to the point of being completely satisfactory. This doesn't mean that you should not buy them. It does mean that you should proceed with care. The steps set out in this Guide will minimize the pitfalls.

6.1.2 Cost of Functional Packages

Proven functional packages for municipalities include tax billing, receivables, payables, general ledger and financial reporting. Based on 1984 pricing, experienced vendors are selling these packages without modification and with limited implementation/training for approximately $2,000 to $3,000 per application. So the four applications listed above would cost from $8,000 to $12,000.

In comparison, standard commercial accounting packages for small businesses may sell in a computer store for $400 to $1,000 each.

Some of these packages are much cheaper because their potential market is huge - upwards of half a million purchasers. In contrast, the Ontario local government market probably approaches 200 for small municipalities.

These cheaper commercial packages are not designed to meet the specific needs of municipal accounting (fund accounting, assessment information, arrears, penalties, etc.). Modifying them to meet municipal needs will probably cost much more in the end than buying the more expensive packages specifically designed for municipalities.

6.1.3 What About Generic Packages?

Since generic packages are designed to be used in any organization, there is less need to worry about their suitability for municipal government purposes. Also, as long as you restrict yourself to the more popular packages, you can rest assured that they are proven. That doesn't mean that they will necessarily meet every one of your particular needs. One package may be easier to use than another.

Advice can be sought from other municipal microcomputer users who are using generic packages, or the Catalogue can be used to identify the more popular packages. If you stay with the popular packages, you may be able to share the applications developed using these tools. It is wise to try these packages before you buy them. Or, let the future operator observe an experienced person using them.

Of the popular generic packages, word processing and spreadsheet programs are the easiest to learn to use. Templates are available for some generic packages. Those who have typing experience can learn to use a word-processing package on a microcomputer within a few days. Operators who have previous word-processing experience will probably need only a few hours. Similarly, it should take from a few days to a few weeks to learn to use a spreadsheet program competently. Complete mastery depends on the user's degree of dedication and the amount of practice. Both types of program permit the user a lot of freedom in devising new applications.

Data base packages are more complex but also very versatile tools. They can easily be used to create simple one-file applications (e.g., a name and address list). They can also be used to create complicated data bases. However, the first-time user would find the latter difficult and should avoid trying to use a data base package in this way.

There is a trade-off between simplicity of use and "richness of function" among generic packages. Usually, the easier a program is to use, the less the variety of tasks it can be made to do and, possibly, the smaller the productivity gain in the longer term. It is worth making the effort to master the "richer" generic packages. It will pay off in your being able to do many more things on your microcomputer for years afterwards.

6.1.4 The Cost of Generic Packages

Because there is a big market for these generic packages,the price of good quality generic software is similar to that of the "simple" accounting packages - $400 to $800 each. They are also sold with little or no implementation support.

Good quality generic packages usually include instruction/tutorial manuals. Review the manuals before purchasing packages. The quality of documentation varies from poor to excellent. Good documentation will generally be enough to allow you to use the package effectively. Poor documentation may oblige you to buy separate tutorial aids or to take training courses ranging in cost from $50-250 per day.

The purchase price of some generic packages includes telephone support. For the price of a long-distance call you can talk to trained technical support people employed by the manufacturer of the package. As with all things, caveat emptor: Let the buyer beware.

6.2 Find Out About Hardware

Once you have found a package that meets your highest-priority needs, only then is it time to look at equipment. Your hardware choice narrows to those microcomputers on which the package will run. Keep in mind that you will want to use the microcomputer for other applications in the future. You do not want to select a microcomputer because a particular package runs on it only to find that it can't handle packages that you subsequently want to implement.

Make sure that the package of your choice runs on one of the microcomputers produced by manufacturers who are likely to be around to support their products for years to come. (Section 5.2 in the Workbook lists questions to ask hardware vendors.)

You also need to find a machine that is capable of handling the planned application workload (i.e., all the functions that you want the microcomputer to perform) and the volumes that must be processed in your municipality.

6.2.1 Equipment Capacity

In the next stage (requirements definition), it will be necessary to document your requirements in detail. What you need now is an estimate of the amount of storage capacity that the microcomputer must have to handle your planned applications. One of the most common mistakes in buying microcomputers is the failure to allow enough storage capacity.

You can estimate these requirements by:

- talking to a municipality of similar or slightly larger size that has already computerized the application(s) that you are considering and therefore knows what capacity is required
- asking an experienced vendor with proven municipal packages for an estimate.

Otherwise, you should undertake a detailed survey of your volumes and an analysis of the capacity you will require at this stage, rather than postponing these tasks until the next stage.

Here is a rough guide to the sort of computer configuration (combination of computer equipment) that a small municipality may require:

TABLE 2

A POSSIBLE CONFIGURATION

APPLICATION PROGRAMS		EQUIPMENT
FUNCTIONAL	GENERIC	
1-2 APPLICATIONS	LIGHT WORD PROCESSING	• RAM (64-256 KB) • 1 CRT • 1 KEYBOARD • 1 PRINTER (80 cps) • 2 FLOPPY DISK DRIVES (320 KB EACH)

This configuration would cost between $5,000 and $7,000 (early 1984 prices). The configuration suitable for your needs could differ substantially. Methods for determining what you need are dealt with in Section 5 of this Guide and in Sections 3, 4 and 5 of the Workbook. The following discussion simply illustrates some alternatives.

The size of the RAM must be large enough to handle the planned applications. Some functional packages currently operate on a 64 KB machine; however, integrated functional packages and generic packages will require a larger RAM (as much as 256 KB or more).

If you plan to run between two and five functional applications, a faster printer (say 180 characters per second) is needed, and so is more memory. Instead of two floppy disks, you may require one hard disk (10-20 megabytes, or MB) plus one floppy disk as backup (320-800 kilobytes, or KB). The equipment cost would be upwards of $10,000.

If your microcomputer applications plan calls for more than five functional applications and heavy word processing, you are moving into the realm of a minicomputer, or a second microcomputer. (Alternatives to the single, standalone microcomputer are discussed later in this section. The Ministry publication, Microcomputers in Local Government: A Manual, deals with the more complex microcomputer systems.)

Your microcomputer's actual configuration will depend on what applications you want to computerize, the size of your records, and other factors discussed in Section 5.

6.3 Consider Other Technical Issues

Maintenance, performance, compatibility, reliability and expandability are other technical issues to take into account. Of these five, maintenance is by far the most important.

6.3.1 Maintenance

The only kind of hardware maintenance available for most microcomputers is remedial maintenance, i.e., when something goes wrong, you ask the vendor to fix it. (In contrast, preventive maintenance is available on a regularly scheduled basis for larger computers.)

For software, maintenance generally takes the form of providing assistance to the user when problems are encountered in running an application package. Some vendors provide this support by telephone. In some cases, it is possible to negotiate with the vendor to make modifications to the package as the need arises, for a charge.

Most vendors who are committed to supporting small municipalities with proven application software will offer their systems only on hardware that is reliable and well supported, with a reasonable service and parts network. Some rural municipalities are considerable distances from service locations. They should look for vendors whose equipment is already installed in their geographical area, or vendors who have a reputation for providing support in remote locations for both hardware and software. (Maintenance is further discussed in Section 8 of the *Guide*.)

6.3.2 Performance

IN 99 % OF OFFICE MICRO DECISIONS,THE SPEED OF THE MICROPROCESSOR IS THE LEAST IMPORTANT CRITERION IN DETERMINING PERFORMANCE

Some microcomputer vendors place great emphasis on the speed of the microprocessor as measured in millions of machine instructions per second. In determining performance, the *most important factor* is not the speed of the processor but *the speed of the operator in entering data and correcting errors*. Don't allow yourself to be distracted by hardware performance claims when selecting your microcomputer. Keep in mind, however, that it will soon be possible to run two or more tasks simultaneously on a single microcomputer. The associated operating systems run on machines with faster and larger microprocessors.

6.3.3 Compatibility

The microcomputer industry is young. There are very few standards and those that do exist are loosely defined and often ignored. As a consequence, microcomputer buyers have to be cautious about compatibility, (the ability of one part of a computer system to work with another). At this point, you need be concerned about compatibility only if:

- you are thinking of buying software that runs on a Brand X microcomputer and running it instead on a Brand Y microcomputer. Beware of claims that software is transferrable. Ask for a demonstration.
- the equipment you are thinking of buying is supplied by different vendors (e.g., the microcomputer from vendor A, and the printer from vendor B)
- you may need to receive data or programs from your microcomputer via diskette or telephone lines from another computer.

Compatibility is a highly technical matter. If you find yourself in one of the three situations described above, it would be wise to get expert advice. Experienced buyers insist that the vendor demonstrate the equipment, programs or files working together.

6.3.4 Reliability

Reliability encompasses:

- the frequency with which the hardware or software programs fail
- how quickly the vendors' service personnel respond
- how quickly and effectively the service person repairs the failure.

Two of the major advantages of office microcomputers compared with home microcomputers is that office microcomputers are more reliable and are better supported with regard to maintenance. Experienced municipal systems vendors and their customers are good sources of information on reliability.

6.3.5 Expandability

Some computer systems have more room for expansion than others.

Your microcomputer system must be able to grow for two reasons:

1. Application growth - as you add more applications you will consume more of your hardware's capacity (keying, printing and processing time, plus disk capacity)
2. Volume growth - as your municipality grows (e.g., more taxpayers) or as you process more information through each of your applications (e.g., more pages of text in word processing) you will also require more capacity.

The addition of unplanned applications is one of the most common reasons for having to expand your microcomputer unexpectedly. A realistic applications plan that schedules what will be installed and when will help determine the correct capacity. When buying a microcomputer, experienced users choose a system which is able at least to double in both disk size and printer speed to handle unforeseeable growth in volumes or applications.

7. ASSESS THE ECONOMIC ISSUES

The decision to purchase a computer is like any other investment decision that a municipality must make. Exhibit 4 presents an example of the possible annual savings, initial investment, annual operating costs and payback period for a microcomputer in a small municipality, given the assumptions stated in the exhibit. Non-financial benefits, such as increased productivity, are also noted on the exhibit.

7.1 Potential Savings

In this hypothetical example, the applications are tax billing and receivables, accounts payable, general ledger, financial reporting, and word processing. The highlights are listed below.

- Annual savings are approximately $25,000, with the bulk of these savings coming from faster generation of tax bills and collection of receivables.
- The initial investment of $30,000 is split equally between software charges, the hardware equipment purchase and

EXHIBIT 4

SAMPLE COST/ BENEFIT ANALYSIS

A. ANNUAL SAVINGS AND BENEFITS

ANNUAL SAVINGS	ANNUAL $
1. DISPLACED COSTS	
• OVERTIME AND PART-TIME STAFF (8 weeks at $ 250 / week)	2,000
• CURRENT EQUIPMENT MAINTENANCE AND SUPPLIES	1,200
2. COSTS AVOIDED	
• EARLIER TAX BILLING (1 month earlier on 4 quarterly installments of $ 600,000 each and investment interest at 10 % p.a.)	
$= \frac{\$600{,}000}{} \times \frac{10}{100} \times \frac{4 \text{ INSTALLMENTS}}{12 \text{ MONTHS}} =$	20,000
3. OPPORTUNITY COSTS	
• FASTER COLLECTION (8 % improvement based on $ 200,000 receivable and 10 % p.a. interest)	
$= \$200{,}000 \times \frac{10}{100} \times \frac{8}{100} =$	1,600
TOTAL ANNUAL SAVINGS	$ 24,800 (A)

OTHER BENEFITS

1. FASTER REPORTING TO COUNCIL (1 week after month-end).
2. IMPROVED PRODUCTIVITY OF STAFF AND EASIER BACKUP.
3. IMPROVED GROWTH CAPABILITIES (time to do inventory control).

B. INITIAL INVESTMENT

• SOFTWARE	$ 10,000
• HARDWARE PURCHASE	10,000
• TRAINING, FORMS, DISKETTES, FILE CONVERSION MISCELLANEOUS, CONTINGENCY	10,000
TOTAL INITIAL INVESTMENT	$ 30,000 (B)

C. ANNUAL OPERATING COST

• SOFTWARE MAINTENANCE	$ 2,500
• HARDWARE MAINTENANCE	1,000
• SUPPLIES AND MISC.	2,500
ANNUAL OPERATING COST *	$ 6,000 (C)

D. PAYBACK PERIOD

- ASSUME A 6-MONTH IMPLEMENTATION IN ACHIEVING FULL SAVINGS REALIZATION
- ESTIMATED PAYBACK PERIOD

$$= \frac{\text{INITIAL INVESTMENT} + \text{IMPLEMENTATION DELAY}}{\text{ANNUAL (SAVINGS - COSTS)}} \text{ (in years)}$$

$$= \frac{(B)}{(A-C)} \text{ YEARS} + 0.5 \text{ YEAR}$$

$$= \frac{30{,}000 \text{ YEARS}}{24{,}800 - 6{,}000} + 0.5 \text{ YEAR}$$

$$= (1.6 \text{ YEARS} + 0.5 \text{ YEAR}) \times 12 \text{ (Months)}$$

$$= 25 \text{ MONTHS}$$

* NOTE:

THE CLERK / OPERATOR IS ASSUMED TO BE ON THE EXISTING STAFF. SINCE THAT INDIVIDUAL'S SALARY IS ALREADY INCLUDED IN YOUR CURRENT (MANUAL) SYSTEM COSTS, IT IS NOT INCLUDED AGAIN HERE.

miscellaneous costs for training, forms, diskettes and a contingency amount.

- The annual operating cost of $6,000 represents budget estimates for software and hardware maintenance, supplies and miscellaneous costs. The cost of the operator's time is excluded.
- If a six-month delay in fully achieving the savings is assumed, the payback period is 25 months.

Depending on the size of your municipality and your applications plan, a similar cost/benefit analysis may be prepared to submit to council with your report (discussed at the end of this section).

You could use Exhibit 4 as a model, inserting your own municipality's cost and benefit figures.

8. WHAT ARE THE ALTERNATIVES?

The microcomputer is a less well-established alternative than other data processing technologies. In addition, the price of hardware and software does not allow for the same degree of vendor support as you would receive with larger computers.

You therefore have to be a committed user to accept the responsibilities of operating and managing your own microcomputer installation. Provided that you can find satisfactory, proven municipal packages and your volumes do not exceed the microcomputer's capacity, a microcomputer may provide the most economic long-term solution to your needs.

Before you reach the conclusion that a microcomputer is the most practical and cost-effective solution for your functional applications, consider the alternatives:

a) **DO NOTHING.** It is possible that your best choice is to live with your present situation. The situation could be reviewed in one or two years.

b) **STREAMLINE YOUR CURRENT MANUAL METHODS.** In taking a look at your current systems and procedures, you may have uncovered practices that could readily be simplified or eliminated. If so, taking these steps may be a sufficient solution.

c) **ADD MORE STAFF.** This may be the fastest alternative to implement. It may also be expensive.

d) **USE A SERVICE BUREAU, OR IF YOU ARE ALREADY USING ONE, TRANSFER ADDITIONAL FUNCTIONS TO THE SERVICE BUREAU.** The service bureau will work well for small municipalities interested in automating only one or two functional applications and not wanting to make extensive use of generic packages. By having your work processed on the service bureau's computer, you can computerize applications on better equipment than you could afford yourself. You may also be able to use their programs rather than spending time and money on programs of your own. Also, if something goes wrong, you don't have to fix it.

e) **USE ANOTHER MUNICIPALITY'S FACILITIES.** There are many variations upon this theme. For example, you may use another municipality's computer and buy a microcomputer of your own but for use as a terminal which is linked to the larger computer.

   Using another municipality's equipment is much like using a service bureau. The main advantage is that they are in the same field as you are, and you may use most or all of their programs. The main disadvantage is that your computer needs may not receive priority.

f) **IF YOUR PRIMARY REQUIREMENT IS WORD PROCESSING, BUY A MICROCOMPUTER FOR THIS PURPOSE.** If the word processing work would consume more than two to three hours a day, it may be cost-justifiable to buy a microcomputer solely for running a word processing application. Another alternative is a dedicated word processor. However, the latter is more expensive than a microcomputer, and, unlike the microcomputer, it can seldom be satisfactorily used as a multi-purpose machine.

g) **ACQUIRE A MINICOMPUTER AND SHARE IT WITH ANOTHER MUNICIPALITY.** If your application workload and volumes exceed the capacity and capability of a microcomputer, you could consider buying a mini instead. It might be possible to share one between two or more municipalities. Or you could share it with another government agency, e.g., a public utilities commission.

The comparative advantages of microcomputers, minis, and shared services are summarized in Exhibit 5, overleaf. You will, of course, need to examine the operational, technical, and economic aspects of the alternatives, just as you have done in considering

EXHIBIT 5

COMPARISON OF ALTERNATIVES

COMPARISON FACTOR	MICROCOMPUTER	MINICOMPUTER	SERVICE BUREAU
1. OPERATIONAL	— Minimal support from most vendors; requires committed user + User determines priorities within equipment limits	± Support varies by vendor + User determines priorities	+ Requires least commitment; use can grow in stages — Scheduling conflicts on quarterly billing, month end; reports may be difficult to get when you want them
2. TECHNICAL	± Packaged software varies in quality by vendor ± Capacity limitations	+ Mature, proven software packages + Better growth capacity	+ Mature, proven software packages + Unlimited growth capacity
3. ECONOMIC	± May be cheapest if technical and operational issues can be resolved, and user wants a total system and a fixed cost — Purchase only, or short-term financial lease (under 36 months) — High cash outlay for initial purchase	+ Cheapest solution for complete, integrated systems if volumes are large and require several terminals, large disk capacity (30-100 MB) and you want fixed costs + Variety of financing plans — More expensive than micros; may be justified if growth capacity is required	+ Cheapest solution for single application or very small municipalities with 1-2 applications + Minimal initial cash outlay + Flexible commitment — Costs vary with volume and may rise due to inflation — Most expensive over 5-7 years if the municipality wants a complete accounting and management system (5-7 applications)

NOTE: + = an advantage
— = a disadvantage
± = there could be advantages and disadvantages.

the microcomputer. You can use much of the information presented in this Guide in doing so.

9. REPORT TO COUNCIL

At this point, you are ready to submit a report to council. Suggested topics for the report are shown in Section 2.2 of the Workbook.

With council's approval, proceed with the next phase: documenting, in as much detail as possible, exactly what you want each application to do (requirements definition). If you already have a procedures manual which records the policies, practices and procedures your office uses, this should be a reasonably straightforward task. If you don't have such a manual, the task will take more time.

When the application requirements have been defined, the next step is to calculate the processing volumes that the microcomputer will have to be able to handle. Knowing your applications requirements and volumes, it is possible to estimate the capacity your microcomputer system will require. You can then take a close look at microcomputer hardware. The next section explains the process of defining your requirements in detail.

5 - DEFINING YOUR REQUIREMENTS

With the preliminary planning completed, you are now ready to do the detailed planning for your microcomputer system. If you were building a house, this would be the stage at which you decided how big each room would be, how many electrical outlets you wanted in each room, and so on.

Why should you take the time and trouble to plan in detail when some people buy microcomputers almost on impulse and seem to be quite happy with them? The answer is that people who buy that way probably do not have stringent requirements, nor will they be relying on a microcomputer to perform the essential corporate functions of a municipality.

The requirements for an integrated municipal accounting system are extensive and complex. They must be carefully defined. Failure to do so will mean that time bombs are built into the system. They will explode at the most awkward point during or after the implementation of the system.

The requirements for generic packages such as word processing should also be defined. In addition, it is necessary to estimate the capacity your hardware will need.

SHARING THE LOAD

One way of reducing the planning workload is to join forces with other municipalities interested in purchasing a microcomputer. This pooling of resources has several advantages.

> Sharing the workload reduces your own time commitment and enables ideas to be shared.

- In the vendor selection phase, two or more municipalities will attract a better response from vendors. It may also be possible to negotiate "volume" discounts on the costs of software, hardware and training.
- In the implementation phase, nearby municipalities with the same application software and hardware can back each other up with equipment and staff if serious problems arise. This kind of backup could be especially important to municipalities a long way from service locations or labour markets.

THE FIVE MAIN STEPS IN DEFINING YOUR REQUIREMENTS

NO. OF DAYS	TASK DESCRIPTION
3-6	1. Define and Document Application Requirements
1-2	2. Determine and Document Volumes
	3. Analyse Capacity
1-2	4. Define and Document Hardware and Operating System Requirements
1-2	5. Review Requirements and Revise
6-12 Days	

These days may be spread over a period of several weeks.

1. DEFINE YOUR APPLICATION REQUIREMENTS

You can approach the definition of your requirements for functional packages in one of two ways:

A. Spend some time looking at what existing packages can do, and then decide which package best suits you; i.e., your requirements are determined by what is available.

B. Draw up a list of your requirements, ignoring for the moment what existing packages actually offer. Look at packages only after you have decided what you want.

Approach A is based on the assumption that, because you are looking at packages designed specifically for municipalities, they will in large part meet your needs. In other words, the requirements have already been defined by the packages' developer and users, so you don't have to spend time on this task.

This approach requires caution. Salesmen (and sales brochures) will naturally emphasize what their products can do, not what they can't do. It is therefore essential to seek some users' opinions if you choose this approach. (Even then, other municipalities' needs may not be identical to yours. So what suits them may not suit you.) Also, if you haven't independently defined your requirements first, it is easy to overlook apparently small differences that may prove to be very significant.

Approach B will require more "upfront" effort on your part. However, if you first think through and write down precisely what you want the computer to do, you will be able to look at packages with an informed eye. If they do not match your needs precisely, you will be aware of their shortcomings and can find out about modifications, or you can decide which of your requirements you are willing to change or forego.

With generic packages, any of the popular ones is likely to meet most of your requirements. However, as pointed out earlier, they are by no means identical, in performance or ease of use.

1.1 Use the Workbook

Approach B, explained above, is recommended. In Section 3 of the Workbook you will find four requirements checklists which show the minimum amount of detail that should be specified for the following applications:

- general ledger
- disbursements and accounts payable
- tax billing and receivables
- word processing.

You can tailor the requirements listed there to meet your municipality's specific needs by reviewing the information in your current systems and the strengths and weaknesses of your current procedures. If you want to computerize an application other than these four, the lists can be used as a model.

No package will meet every one of your requirements. Therefore, you will need to decide what your essential requirements are (those requirements about which there can be no compromise) and what features are desirable but not vital for success. The checklists distinguish between essential and desirable requirements.

1.2 Visit Other Municipalities

The Catalogue will identify the municipalities that have computerized the applications you are considering.

1.2.1 Functional Applications

You can gain very useful insights from visiting other municipalities that have installed integrated accounting systems on mini or microcomputers. Experienced users are generally glad to explain the strengths and weaknesses of their computer system and to show you some of their system documentation (reports, input documents, file layouts).

1.2.2 Generic Applications

The Catalogue will enable you to identify municipalities that are using generic packages you may be considering. You can telephone or visit these municipalities to discuss the packages or see them in use. If you choose a package that several other municipalities are using, you may be able to share their municipal procedure manuals. It is illegal to obtain copies of the actual programs and the program manuals published by the package producer from anyone other than the producer or licensed distributors.

1.3 Review Vendor Documentation

Sales literature is available from vendors for different software packages. Vendors of functional packages are listed in the Catalogue. In the case of generic packages, you may find it useful to read reviews in computer magazines. Some articles contain feature-by-feature comparisons of packages - a big help to prospective buyers. Your local or regional library should be able to track down such articles for you.

2. DETERMINE VOLUMES

Having defined and documented what you want the application software to do, the next step is calculate quantities - how much of everything the microcomputer system will have to handle - in order to determine the capacity your system will need. The volume survey is the key to determining hardware or equipment capacity, hardware cost, and the technology alternatives (microcomputer, mini or service bureau). It will also help identify the potential vendors.

For each application, it is necessary to estimate:

- how many documents there are at peak times, (i.e., the maximum amount that the computer will have to handle), and
- how long you want to keep detailed information in the computer.

These volumes will be used in step 3 to analyze the capacity your microcomputer will need.

Section 4.1 in the Workbook contains a form you can use for the volume survey together with instructions on how to calculate the various volumes.

3. ANALYZE CAPACITY

If a computer proves to be too small six months after it has been installed, the usual reason is that no attempt was made to figure out the required capacity before purchasing the equipment. Instead, the buyer relied on the equipment configuration recommended by the vendor.

By determining the capacity that the microcomputer must have to meet your needs now and in the future, you won't have an unpleasant surprise a short time after buying your microcomputer. You need to know what capacity you require for all four main components of the microcomputer:

- the disk, measured in millions of characters or bytes (MB) to be stored
- the printer, measured in hours of printing per month
- the keyboard, represented in hours of typing per month
- the processor, measured in hours of processing per month.

Knowing your volumes, you can calculate the microcomputer's capacity. Section 4.2 of the Workbook shows the kind of information to be gathered and the calculations to be made. Instructions on how to complete your capacity analysis are also provided.

The design of both the application software and the vendor's equipment can affect capacity. It is wise to insist that any vendor proposing to sell you a system prepare his own capacity analysis and present it to you, using the information you give him about your application workload requirements and processing volumes. For example, you may want to save your general ledger (G/L) detailed postings for twelve months. In this case, the G/L detail file will probably be your largest computer file. You will therefore need more capacity to accommodate it, and you will want to be sure that the vendor hasn't overlooked this requirement.

You can also contact the people whose names the vendor has provided as references, as an informal method of verifying the capacity. They should be municipalities of about the same size that have computerized the same applications as you want to computerize.

4. DEFINE HARDWARE AND OPERATING SYSTEM REQUIREMENTS

4.1 Define Hardware Requirements

Requirements should be specified for each of the following hardware components:

- type of microcomputer system
- microprocessor
- disks
- terminal (CRT and keyboard)
- printer
- communications
- other, e.g., voltage regulator.

4.1.1 Type of Microcomputer System

Your first hardware decision will be based on the results of your capacity analysis. It will determine what type of computer system you will require. Some alternative systems are as follows:

- A microcomputer which has only one terminal and one printer and is capable of running only one job at a time, i.e., a single-terminal microcomputer.

- A multi-terminal microcomputer which is capable of supporting 1-3 terminals and up to two printers. This type of system would be suitable for small municipalities that envisage a sizable application workload (tax billing and receivables, water billing and receivables, hydro billing and receivables, a complete accounting system and terminals for word processing).

- A multi-terminal minicomputer. A minicomputer is preferable when a small municipality requires more than three terminals because of its application workload and volumes. This situation could arise if two municipalities (each with fewer than 5,000 residents) decided to share a computer.

If you opt for the second or the third alternative above, you will find Microcomputers in Local Government: A Manual useful reading.

Multi-terminal microcomputers do not perform as well as multi-terminal minicomputers at present. If you you want a multi-terminal microcomputer, ask the references named by the vendor how well the system performs (response time at terminals and overall speed). The vendor should provide a guarantee of performance in any contract to buy a microcomputer system, whether multi- or single-terminal.

4.1.2 Other Hardware Features

A hardware requirements checklist appears in Section 5.1 of the Workbook. Hardware considerations are explained there, and hardware features are identified as essential or desirable.

4.2 Define Operating System Requirements

It is an advantage to have a widely used operating system for your microcomputer because it may allow you a wider choice of application packages. Similarly, choosing an application package (functional or generic) written to run on a widely used operating system will allow you, in theory, to avoid or reduce conversion costs if you move your applications from one make of microcomputer to another. In practice, the costs of converting functional packages may amount to more than the cost of buying a new package.

The important thing is to find the right application package first, and then find a microcomputer with the operating system for which that software is written. The operating system requirements will therefore be predetermined by the chosen application package.

5. REVIEW AND REVISE REQUIREMENTS

Once the requirements have been drafted, you may decide to compare your specifications with those produced by officials in other small municipalities. Based on their comments and your own comparisons, you can make any necessary revisions.

6 - SELECTING THE VENDOR

When and how you go about "shopping" for your microcomputer system depends on what you plan to use your microcomputer for and what type of system you want.

If you are looking for a single-terminal system on which you intend to run one or more popular generic packages, you have a reasonably wide choice of vendors. If, however, you are intending to use the microcomputer for functional applications, your choice is much more restricted, and the selection process has to be much more rigorous, since there is so much more at stake. There are also far fewer packages to choose from.

THE MARKETPLACE

In either case, there is an important fact about the microcomputer marketplace that has several implications for the buyer:

THE COMPARATIVELY LOW PRICE OF MICROCOMPUTERS HAS LITTLE TO DO WITH TECHNOLOGY AND A LOT TO DO WITH THE WAY IN WHICH MICROS ARE SOLD AND SUPPORTED.

You Have to Do the Comparison Shopping

Microcomputer vendors operate on narrow profit margins. Accordingly, most vendors are neither willing nor able to spend a lot of time helping you to select a microcomputer. The buyer is expected to do the "walking and talking" necessary to understand the differences between products.

Get it in Writing

It is standard practice when buying larger computer systems to send out a formal document called a Request for Proposal (RFP) to vendors. This document sets out the software and hardware requirements in considerable detail and asks vendors to respond with a proposal to meet these requirements. Because microcomputer vendors have small profit margins, they are generally unwilling to prepare extensive proposals. Nevertheless, for your own protection, *your requirements* should be given to the vendor *in writing*, and *his offer to supply you with products* and services should be put *in writing*. Your documented requirements and the vendor's written response will avoid misunderstandings and will be a useful addendum to any purchase contract. A municipal microcomputer system must not simply be picked off the shelf.

You Get What You Pay For

Another consequence of small margins is that if microcomputer vendors provide help with installing the system and getting it running, they will probably charge extra for this service. The focus when selecting a microcomputer should *not* be on identifying the vendor with the lowest price. Rather, you should concentrate on finding the vendor with the highest-quality application software and the best reputation for support. Good software and good support will cost more than basic software and no support. These benefits are worth the extra cost.

THE VENDOR SELECTION PROCESS

The major steps in selecting a vendor (or vendors) are:

1. Identifying qualified vendors
2. Dealing with vendors
3. Evaluating vendor responses
4. Selecting the best vendor
5. Keeping council informed
6. Negotiations

TWO APPROACHES TO SELECTION

The way in which you select a vendor will naturally have to conform with your municipality's purchasing practices. Within those constraints, however, there are two basic approaches to following the six steps listed above:

- the formal approach, which involves issuing a request for proposals (RFP) to vendors, and using a selection procedure that has several stages
- the informal approach, which does not involve an RFP and which has fewer stages.

Each approach has advantages and disadvantages as highlighted below:

TABLE 3

FORMAL vs. INFORMAL SELECTION APPROACH

FORMAL APPROACH	INFORMAL APPROACH
(+ = ADVANTAGE ; − = DISADVANTAGE)	
+ SIMPLIFIES EVALUATION FOR THE BUYER	− PLACES GREATER RESPONSIBILITY ON THE BUYER FOR EVALUATION
+ REQUIRES LESS BUYER TIME DURING EVALUATION AND SELECTION	− REQUIRES BUYER TO SPEND MORE TIME ON EVALUATION AND SELECTION
+ PROVIDES A VERY COMPREHENSIVE DEFINITION OF THE REQUIREMENTS	− MAY LEAVE ROOM FOR MISUNDERSTANDINGS
+ REDUCES THE CHANCES OF MISUNDERSTANDINGS AND SUBSEQUENT DISPUTES	+ REQUIRES LESS TIME BEFORE CONTACTING VENDORS
− REQUIRES MORE BUYER EFFORT BEFORE CONTACTING BIDDERS	+ REQUIRES VENDOR TO SPEND LESS TIME ON PREPARING A RESPONSE
− REQUIRES THE VENDOR TO SPEND MORE TIME PREPARING A PROPOSAL	

The formal approach is preferable when:

a) there are three or more qualified potential vendors; and/or

b) your needs are more complex than the few applications on which this Guide and the Workbook focus, or

c) you must tender all purchases in accordance with your bylaws.

The informal approach is preferable when:

a) there are only one or two qualified potential vendors, and

b) you plan to run no more than the applications dealt with in this Guide and the Workbook, or

c) you plan to use the microcomputer primarily for word processing and perhaps some other generic packages.

The formal approach, using an RFP, is detailed in Microcomputers in Local Government: A Manual. **THE INFORMAL APPROACH IS DESCRIBED BELOW.**

1. IDENTIFYING QUALIFIED VENDORS

1.1 Vendors of Functional Packages and Hardware

Functional microcomputer-based packages that are designed to meet municipal needs are sold by very few vendors at present. These vendors generally sell the software and will also supply the hardware on which this software runs.

You can use the Catalogue to identify potential vendors. Talk to other municipalities with successful microcomputer installations, the Ministry's field officers, and MISA members to whittle down the list and get the latest information on vendors.

Once you have identified one to three experienced municipal microcomputer vendors, contact each of them by telephone. The purposes of this initial contact are to establish:

- what municipal software they currently offer (or whether they are interested in developing municipal software)
- what their relevant experience is (they should be able to name municipal microcomputer references)
- whether they are able to support and maintain your installation during implementation and throughout the life of the system.

For your part, you should be able to communicate your needs clearly and thoroughly to the vendor. He or she should be convinced that your municipality is a serious prospect - that you are not merely window-shopping.

In some cases, you may feel obliged to contact a vendor who is established locally but who has no proven software or relevant references. There is nothing wrong with this, but remember that it is virtually impossible for an inexperienced vendor to match both the quality and the price of an experienced vendor's package. If the prices are comparable, the inexperienced vendor's software could have significant deficiencies.

1.2 Vendors of Generic Packages and Hardware

If you are planning to use your microcomputer primarily for functional applications, with, say, a little light word processing, your choice of generic packages is restricted. Why? Because the functional applications will determine the operating system and thus your choice of microcomputer. Consequently, the generic packages you buy must be capable of running on the same hardware and operating system. The task then is to identify a word processing (or other generic) package that meets this requirement. The vendor(s) of functional packages should be able to tell you which popular generic packages can be run on the same equipment.

If you intend to use your microcomputer solely for running generic packages, you can shop around at computer retail stores for both generic software and the hardware.

Look for a retailer (preferably local) who can support the generic package you want, i.e., you can telephone the retailer if you have problems and be given advice. Some training programs or other training aids should also be available from the retailer. Although some generic packages can be obtained by mail order, you will have no one to turn to if you run into problems with packages purchased this way.

As for hardware, there are manufacturers' distributors and both chain and independent retail stores that you can visit. Department and other "non-specialist" stores such as office suppliers also sell equipment but, again, they may not offer the support you will need if you are new to microcomputers.

2. DEALING WITH VENDORS

2.1 Vendors of Functional Packages and Hardware

It is vital to supply vendors of functional packages with a written statement of your requirements for both software and hardware. (Requirements checklists are provided in Sections 3 and 5 of the Workbook.)

To minimize the vendor's work, you can also supply cost tables and add comments as necessary. Sample cost tables are provided in Section 6 of the Workbook. The vendor returns these tables to you as part of his written response.

It is common practice to allow vendors about three to four weeks to submit their responses from the date of sending or giving them your written requirements.

Vendors may be concerned about their package's ability to supply either essential or desirable features. It is important to remember that no vendor will meet 100% of your requirements. Therefore, vendors who can meet 70-80% of your requirements should receive further consideration. Encourage vendors who can achieve the intent of a particular requirement (through some other feature) to recommend alternative ways of satisfying the requirements. In other words, all reasonable ways of meeting a particular requirement should be considered.

It is also common practice to disqualify vendors who attempt to deal with non-designated officials in the municipality.

2.2 Vendors of Generic Packages and Hardware

If you are buying generic packages only, your best source, as stated earlier, is a computer retail store. The retailer is usually not the original writer of the software. He should nevertheless be able to tell you in general terms whether the package does what you want it to do. But the onus is on you to establish this; he may, for example, allow you to examine the package's manual to compare the package with your list of requirements or allow you to operate the package on a trial basis.

With regard to hardware, the retailer should be asked to respond in writing to your documented hardware requirements, and should complete the pertinent cost tables (in Section 6 of the Workbook). He should be able to advise you about brands of equipment he sells and about equipment capacity and performance.

3. EVALUATING VENDOR RESPONSES

The purpose of evaluating responses is to make a thorough assessment of the vendors' responses and to do so as fairly and objectively as possible. A method of evaluating the vendors' responses is set out in Section 7 of the Workbook. The method will help you to weigh the various factors to be considered and to rank the vendors.

4. SELECTING THE BEST VENDOR

4.1 Vendor Presentation

A vendor presentation should be arranged with the best vendor as well as at least one site visit to a suitable municipal installation. You, your selection team (if you have one) and the staff who will be using the microcomputer should plan on spending one full day with each vendor: half a day at the vendor's offices and half a day at one of the vendor's municipal clients.

The questions listed in the software and hardware vendor checklists, contained in Sections 3.5 and 5.2 of the Workbook, can be modified to suit your own needs. Work through your tailored checklists with the vendor after he has given a demonstration of his software and hardware.

Apart from meeting the principals in the organization, you should meet the individuals who would be assigned to work with you, determine their relevant experience and see how you get on with them. (You will be working with them for some time while your system is being implemented.) Take a brief tour of their operations, and review samples of their systems and user documentation.

4.2 Questions

You can use the software and hardware reference checklists in Sections 3.6 and 5.3 of the Workbook to tailor a list of questions to ask the vendor's customer references. At the customer site(s), you should talk to both the clerk-treasurer and any office staff who use the equipment to obtain their views on the strengths and weaknesses of both the software/hardware and the vendor(s). Invite them to share their experiences and to make suggestions to help you in your efforts.

4.3 Re-evaluate

After the vendor visits and the customer site visits, re-evaluate the vendors. Use the original selection criteria, supplemented by your insights gained from the visits and from the answers obtained to your questions.

Go with the vendor whom you think has the best experience, software and reputation for support and with whom you feel most comfortable. That vendor may not have written the best proposal or have offered the most sales promises ("Our system can do anything you want!"). However, that vendor is most likely to install the system quickly and satisfactorily.

5. KEEPING COUNCIL INFORMED

It is essential to keep council informed about the project from the inception of the study and throughout the process. You must let them know what you plan to do and how long it will take. The frequency and detail of the status reports will depend on what council wants.

You will likely want to prepare a final report to council on your computer recommendations. This report could be two to three pages in length and should cover the following topics:

a) The process that was followed and the people involved

b) The analysis of the proposals and evaluation findings (include a copy of your final evaluation summary)

c) The major findings resulting from vendor presentations, site visits and reference checking

d) A final recommendation

e) Budgets, schedule and contract issues

f) Supporting material (sample reports, extracts from the vendor responses or your evaluation). Supporting material need be provided only if there are specific matters about which council will require information.

6. NEGOTIATING WITH THE CHOSEN VENDOR

Upon reaching a final decision, notify the preferred vendor of your intention to proceed, subject to resolving the contract, implementation scheduling and staffing considerations.

You should collaborate with your municipality's lawyer in drawing up the contract. In order to minimize disputes, the following documents should be attached to the contract as appendices:

- your original statement of requirements and your volume survey
- the vendor's written response to your requirements, including his capacity analysis
- the agreed-upon schedule for implementation.

Finalize any other terms that your lawyer considers should be added, modified, or deleted from the vendor's contract. The terms of contracts for hardware are seldom flexible. However, there are several issues concerning both hardware and functional application software that must be negotiated and then stated in the contract's terms:

- payment terms including down-payments, progress payments and holdbacks
- delivery dates
- warranties and penalties with regard to the performance requirements to which the vendor has agreed
- copyright protection on application software
- ownership of software
- assistance with installing the system and making it operational, including the conversion of any computer-based files you may have
- training, and documentation provided
- maintenance terms (scope of services and costs).

When the contract has been signed, each of the unsuccessful vendors should be notified and thanked for their participation. You could explain to them in general terms why they were unsuccessful (e.g., lack of proven software, inexperienced staff, inadequate capacity analysis, etc.).

7 - IMPLEMENTING YOUR MICROCOMPUTER SYSTEM

This section deals with the essential steps required to get you, your staff, and the vendor off to a successful start. Assuming that the microcomputer will be used to run functional packages, it may take as long as a year from the time you start the implementation phase to reach the point at which the first three applications are up and running. Any subsequent applications will probably take about three months each to complete.

The steps to be followed if you have purchased the microcomputer solely for word processing or for running some other generic package are described at the end of this section.

1. DRAW UP AN IMPLEMENTATION SCHEDULE

If defining your computer requirements resembles the planning that you do to build a house, the planning for implementation is like planning your move into the house. You will need a comprehensive list of what has to be done, when, by whom, and when each task will be finished. Don't schedule things too tightly. You will need time in hand to allow for the unforeseen and for people to adjust to all the changes.

The easiest approach is to start by confirming the sequence in which the applications are to be installed, taking into account the critical dates, e.g., when tax bills are to be issued. You don't want the computer to arrive in the middle of your peak period.

While an application is being installed, the existing system has to be kept going - so the microcomputer installation means that extra work has to be done. This extra work must be kept in mind when you are scheduling the implementation tasks and their sequence. From this overall plan, a detailed schedule can be developed for each application.

Functional Packages

Exhibit 6 presents a list of the major tasks to be done when installing functional packages, and a schedule for accomplishing them. Note that timing will depend on your environment - how complex the application is, how much modification is necessary, what skills your staff have, and so on.

Generic Packages

If you are planning to do a little light word processing, you could consider introducing word processing first. It is not shown on the schedule in Exhibit 6, but could quite easily be commenced after steps 8 and 9 are completed. There are advantages to learning how to use the word processing package before attempting the functional applications. It will familiarize the operator with the microcomputer, it can be learned quickly, and it will put your machine to work immediately. On the other hand, you will have plenty to keep you busy while getting ready for the functional applications, so you may not want to divert your efforts to this use of the microcomputer.

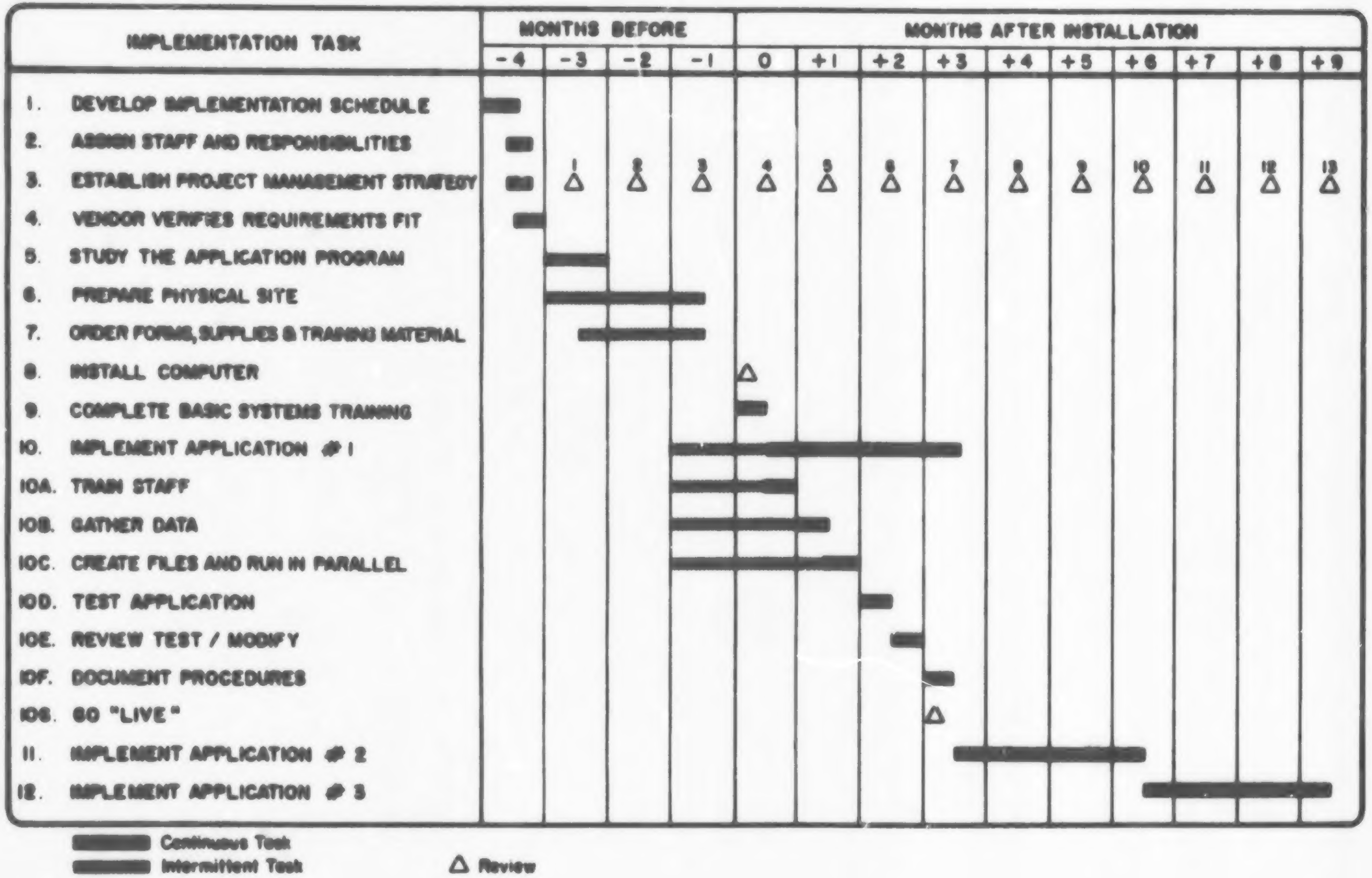
Another alternative could be to implement a word processing package concurrently with your second functional application. Decide with your staff and vendor what sequence is best for you.

2. ASSIGN STAFF RESPONSIBILITIES

Identify and assign each task. Staff assigned will work with the vendor manager.

EXHIBIT 6

IMPLEMENTATION SCHEDULE



3. ESTABLISH PROJECT MANAGEMENT PROCEDURES

Establish procedures for reviewing the progress in implementation, e.g., weekly or monthly review meetings.

4. VENDOR VERIFIES THE REQUIREMENTS FIT

Shortly after the contract has been signed, the software vendor will usually spend one to two days verifying the volumes and establishing that the package fits the requirements. You and he will confirm your special requirements, the programming and testing times, and the additional documentation to be prepared. The vendor should complete any modifications to meet your special needs before implementation (step 10 below) begins.

The vendor should supply you at this point with a complete set of user documentation, including samples of all reports, forms, screen layouts and operator instructions.

5. STUDY THE APPLICATION DOCUMENTATION

Study the documentation closely. The aim is:

- to become familiar with precisely what is to be input and in what format, what processing steps will be followed, and what output will be produced
- to compare the input, processing and output with your present procedures.

The comparison will pinpoint the changes that will have to be made to your present way of doing things. Besides changes in existing procedures (e.g., attaching codes to all purchase orders and invoices), you are also likely to need some completely new procedures. New forms may also be necessary; there may be changes in the usual timing of activities; routine procedures may have to be revised. (These are only a few of the possible changes.) Everyone affected will have to learn the new way of doing things.

You can use the master file input forms, supplied to you by the vendor as part of the user documentation, to record all the "fixed" data (i.e., information that is unlikely to change) in each of your existing master files. Assuming, for example, that you are implementing an accounts payable package first, all vendor name and address data would be recorded. By filling in these forms now, you will have complete and properly organized information ready when the time comes to enter it into the microcomputer.

The information entered has to be exact. For example, you cannot leave out the postal code when you are entering an address. Also, information must be entered in the prescribed sequence and format - which may be quite different from those used in your existing files. By cleaning up your records and transcribing them as a separate activity from entering the data into the computer, you will be able to create your computer files efficiently and complete the implementation faster.

Unlike people, computers are not tolerant of departures from prescribed practice, or of "little" mistakes. Everyone has read newspaper stories about, for instance, telephone subscribers receiving monthly telephone bills for astronomical amounts. The same thing can happen to taxpayers' bills as a result of those "little" mistakes. Transferring tasks to a computer entails looking at your present and future office procedures with a magnifying glass. "Front-end" effort will pay off in a smooth transition to automated systems that perform the way they are supposed to perform.

6. PREPARE THE PHYSICAL SITE

Electricity

A microcomputer will operate on standard 110-volt AC power. It is best to have a separate circuit-breaker and line from the control panel to the electrical outlet you will be using. The circuit-breaker should be labelled, so that someone does not accidentally throw it when you are halfway through a big job. If your electrical power is inclined to surge, you could install power filtration equipment or voltage regulators, available from computer stores. This will prevent processing errors or physical damage that can be caused by surges. Light bulbs may tolerate flickering; computers commit a quick and quiet suicide at the first little burp in power.

Location

The microcomputer does not belong in an inaccessible, dark corner of the office where it is hard to get at and use. Heat will probably build up if it is located in a small, unventilated room. Nor should it be placed in the direct glare of sunlight (it makes the screen hard to read). You may wish to locate it near a telephone so that you don't have to leave the micro in order to take or make telephone calls.

Do not place your microcomputer on a carpet, since the static build-up can cause equipment failures. If this is unavoidable, place the machine and its furnishings on a grounded, anti-static mat. It is also a good idea to keep the microcomputer and your supplies in a reasonably humid environment (this may require a room humidifier in winter). The microcomputer and its surroundings should be kept as dust-free as possible.

7. ORDER FORMS, SUPPLIES AND TRAINING MATERIAL

About three months before installation, you should start designing any special forms (tax bills, cheques, etc.), with the guidance of your software vendor, who should supply samples. Once a final draft version of the new forms has been approved, you can get printing quotations and order the necessary supplies. Printing can take up to two months depending on the supplier. Using the vendor's standard forms may be a less expensive alternative than using custom-designed forms.

Also, obtain quotations for and order other supplies such as stock tab paper, printer ribbons, diskettes, etc. If you are using the same supplier as another municipality or public agency, you may obtain better prices by pooling your orders.

Your hardware and software vendors will be the primary source of training materials. However, you may want to take some preliminary training or you may want to supplement the vendors' materials. Some possible sources are suggested in Appendix B.

8. INSTALL COMPUTER

Depending on what you have arranged, the vendor may deliver and hook up the microcomputer and its peripherals. If this hasn't been arranged, the operating manual should explain how to connect the pieces of equipment. Read the instructions before turning the machine on for the first time.

With larger types of computers, file conversion and training commonly begin before the computer is installed. Not so with microcomputers. It is usually more convenient and less costly to install the computer in your office before doing any application training and file conversion.

9. COMPLETE THE BASIC SYSTEMS TRAINING

Most hardware vendors supply some form of basic systems training material on how to use the computer. These manuals show how to install and operate the computer. Approximately two weeks should be allowed for this training to ensure that the project manager and the operator have mastered the basics before starting work on implementing the applications.

Be prepared to devote a reasonable block of time to training. Experienced users have found that trying to train operators for half-an-hour here and another hour there doesn't work. It may even be necessary to bring in part-time or temporary staff to enable you and your regular staff to get on with the microcomputer project.

10. IMPLEMENT APPLICATION #1

There are six major steps in installing functional applications (shown as Tasks 10A - 10F in Exhibit 6). A good software vendor will assist with the first three steps: training staff, gathering together your data to create the computer files, and converting any existing computer-based files, such as assessment files or accounting records.

A. Train Staff

When the vendor delivers the application program, he may provide a tutorial diskette that you can use for training the staff in running the application. Or he may spend a day teaching you how to create a file, post sample transactions, and generate reports. Alternatively, he might teach you how to create a file and then return some weeks later, as agreed upon. By this time you will have created all your master files, and you can get on with learning how to test and operate the system.

A WELL-TRAINED USER/OPERATOR IS VITAL TO THE SUCCESS OF THE SYSTEM. TRAINING IS ONE AREA THAT IS TOO OFTEN OVERLOOKED IN THE RUSH OF ENTHUSIASM TO GET STARTED. THE AMOUNT OF TRAINING AND THE CONFIDENCE OF THE OPERATOR STRONGLY INFLUENCE THE SPEED AND SUCCESS OF THE IMPLEMENTATION.

B. Gather Data

If you have already recorded your "fixed" data (vendor names and addresses), as suggested in Step 5, you will now be concentrating on "variable" or transaction data - data that changes. (If you haven't gathered your fixed data yet, you must do so now.)

Continuing with the accounts payable example, at the end of an accounting period, balance all A/P subledger accounts to the control account in the general ledger. Once you have made certain that the accounts balance, you can start transferring the account balances by vendor (comprising all the outstanding invoices) to the computer.

You may have some computer-based files that need to be converted. This will be the case if you have been using a computer service bureau, for example, to process tax billings. Unless the vendor has demonstrated that he can convert your computer-based files to your microcomputer format, you will have to convert them manually.

C. Create Files and Run in Parallel

With the application program loaded into the computer, enter the fixed data into the computer and then the transaction data. Now you are ready to start running the computer system "in parallel" with your existing system - that is, the two systems run side by side until you are satisfied that the new system is performing as it should. While operating in parallel, use blank paper (not custom forms) for printing the computer's output. You certainly don't want to produce duplicate cheques - or any other duplicate records.

There are two useful alternatives to parallel running with current operations. One of these is to enter detailed transactions for some past period or part of a past period, run the program using these data and then check the results against those obtained for that period using the old system. The main advantages of this procedure are: 1) you can do the run outside peak workloads, 2) you are paralleling work known to be accurate and 3) you are creating historical files that you may require in any event. This approach is called an historical parallel run.

Another method of testing is to select only part of a file for parallel running under either method described above. While not as comprehensive as the other two methods, this partial running has the advantage of requiring less staff time than the other methods.

Provided that you are working with proven software and you can get through the month-end with fewer than 5-10 errors (and all the errors originated outside the computer system), you are nearly ready to lay your old system to rest. However, those errors should be traceable to posting errors, not training or software problems. If the errors are caused by the latter, more training or program modifications may be necessary.

D. Test Application

Before cutting over from parallel operation to using only the computer, carry out some tests. You want to establish that certain errors do not occur, for example:

- use of invalid vendor codes or G/L account numbers
- alphabetic characters entered in numeric fields and vice versa (e.g., trying to enter the word "January" instead of the numbers "01" for the month)

- values beyond the specified range, (e.g., writing a cheque for more than $100,000)
- erroneous conditions (e.g., creating two cheques with the same number)
- breaches of policy (e.g., processing invoices for overspent budgets without special authorization).

When you deliberately enter invalid data (e.g., a dollar amount that is greater than the amount authorized for a particular account), the computer should respond by rejecting the data or by displaying an error message on the screen. Ensure that the operator fully understands what each message means and how to handle it.

Mistakes such as entering valid but incorrect data (e.g., a wrong vendor code) will occur. Find out how to correct such mistakes, and what safeguards are in place to prevent them happening.

The computer vendor can help you to develop a series of tests to check for the conditions described above.

E. Review Test Results and Modify

The tests should verify that the software works as stated and that your staff fully understand and follow the operating instructions. Most errors occurring in response to tests of proven software are due to operator misunderstanding. Re-draft the written instructions in the operating manual as necessary. The software vendor should fix any problems if the programs are at fault.

F. Document Procedures

It is imperative that the procedures for the computer systems in your office be written down. Step-by-step descriptions must be documented and kept up to date, specifying:

- how to run the application (computer operations documentation)
- how to prepare and correct input
- how to use the computer's output.

Good documentation makes it easy to carry out procedures consistently and ensures continuity.

G. Go "Live"

Once you can successfully reconcile both the old system and your new microcomputer system, and you can trace all errors to the old system for an accounting period, you can go "live". Proper verification and parallel testing of a proven package should take from one to two months, provided that your staff have been properly trained.

11 and 12: IMPLEMENT OTHER APPLICATIONS

After the initial application has been successfully installed, the other applications can be implemented at the rate of about one every three months. Thus, if you are planning to implement four applications on your microcomputer, complete implementation will take about a year from the installation date of the computer. Municipal people have generally found that attempts to proceed at a faster pace, particularly with few staff, result in problems, as staff are not thoroughly familiar with one application before starting the next.

Before commencing the installation of the next application, it is worth reviewing the installation just completed. You will undoubtedly have learned some valuable lessons that can then be applied to subsequent implementation efforts.

INSTALLING A GENERIC PACKAGE

If you have purchased the microcomputer solely to run generic packages, the implementation process described above can be greatly simplified. Only a simple implementation schedule is needed - mainly to plan the time for training. Steps 2, 3, 4 and 5 require very little effort. Steps 6 through 9 apply.

Step 10, implementation, is quite straightforward. Load the generic package into memory and allow the operator to get on with learning how to use it. The software vendor will provide a manual, and may provide a tutorial diskette for computer-assisted training. However, with word processing and spreadsheet programs, mastery is largely a matter of patience and practice. Other possible training sources are discussed in Appendix B.

Data base programs are not quite as straightforward to master. Generally, they should not be attempted by an inexperienced user as an initial application. If you want to use a data base package first, start with a simple "list-type" application (e.g., a name and address file, or a list of maintenance projects), and look for an experienced user with whom you can work when designing and developing the application. If this is successful, try other uses.

8 - OPERATING YOUR MICROCOMPUTER

When the implementation activities have been completed, most people feel a lot more confident about using the microcomputer successfully. The vendor's training material and operating manuals give you the "hands-on" information you need to operate your microcomputer system. This section of the Guide supplements that information with some practical advice on various management and administrative matters.

OPERATIONS RESPONSIBILITIES

Keeping your system working satisfactorily means that somebody has to be assigned the following responsibilities:

- scheduling machine use
- maintaining the integrity (accuracy and "up-to-dateness") of the data and the programs
- keeping the equipment and the software in good condition and contacting the vendor when problems occur
- controlling the input and use made of the microcomputer, and distributing the output
- ensuring that the microcomputer system and all data are kept secure
- training new operators.

BACKUP PROCEDURES

Most people wouldn't dream of driving a car any distance without a spare tire. A backup operator and backup copies of all data files and programs are the equivalent of the spare tire. It is strongly advisable to have a trained backup operator who can take over when needed.

A file that may take hours or days to create can be wiped out by equipment or disk failures, power failures, or program or operator errors. By following the software vendor's instructions on making backup copies, you will avoid the real danger of losing a lot of work. And backup copies take only minutes to make when done daily. You may spend about an hour at the end of the week performing a complete backup of all system files and programs. This is time well spent.

The daily or weekly backup copies of all files should be stored at some other, safe location, such as a bank deposit box or at your home. A copy of all programs and all documentation should be stored off-site as well.

A backup taken while processing a long job, such as creating the budget using an electronic spreadsheet, is also recommended. Experienced microcomputer operators will stop every couple of hours and take a few minutes to make a backup copy in case something happens to destroy their work.

It is not necessary to have a backup microcomputer. However, you may want to make arrangements with another municipality or organization in your area that has the same equipment as yours, should an emergency arise.

OPERATING CONTROLS

As a matter of good housekeeping, it is wise to keep a diary, or paper log, recording the following:

- date
- time
- operator initials
- program name (e.g., word processing)
- description of work (e.g., draft minutes)
- balancing totals (e.g., created 4 pages of text)
- comments/exceptions (e.g., file name for minutes).

The microcomputer makes it practical for a single individual to carry out all accounting tasks in a small municipal office. However, external auditors may be concerned about separation of duties, i.e., one person should not be responsible for processing all of the financial information. If this concern applies, a solution in an office with more than one staff member is to ensure that all balance and edit reports and journals (with appropriate balancing totals) are reviewed by a second person. Occasionally, the edited reports should be verified against the original source documents by a second party. The balancing control totals, number of errors and file names should be recorded in the log.

The paper flow of source documents is much like that for an accounting machine. Thus, the operator prepares a control tape on an adding machine, showing at least the total dollar value of the batch of source documents and possibly the number of documents or transactions on the documents. Balancing totals and control tapes are essential to ensuring that all documents are processed accurately and completely.

DOCUMENTATION

The documentation for your microcomputer system is your silent data processing manager. It's worth re-emphasizing the importance of having on hand the vendor-supplied manuals for the application programs, the operating system, and the hardware, plus the documentation that you produce, detailing your own office's routines. This material should be housed close to the computer.

Each person who will be operating the microcomputer should be required to read the operator documentation before trying to use the microcomputer for the first time. Also, inexperienced users should refer to the manual when learning how to correct error conditions. About half the service calls that both hardware and software vendors receive concern problems that could have been resolved through users consulting their manuals.

Some systems have few user manuals because the documentation is provided in the form of on-line help in the computer programs themselves.

SECURITY

Because microcomputers are small, they are quite easy to steal. Because they are comparatively easy to use, both the programs and the data stored in the microcomputer are vulnerable to misuse - either accidental or deliberate.

The equipment is best kept in a room that can be locked or to which access is restricted. If the microcomputer is placed in an open office, there are two options. A cabinet can be purchased in which the entire system - equipment, documentation and on-site backup copies - can be locked up. Or you can buy a power-supply panel that can be locked. It will effectively restrict access to the microcomputer to those people with a key. Backup copies and documentation will then have to be locked up separately.

SERVICE AND MAINTENANCE

Vendor personnel normally carry out hardware maintenance. For software, functional packages should be maintained by the software vendor. Generic packages (e.g., word processing) are usually designed not to be modified by either users or retailers of these packages. Instead, they are maintained by the software creators or producers.

Hardware Maintenance

Microcomputers are durable, but don't chance your luck. Leaving a cup of coffee on top of the CRT or near the keyboard could lead to unfortunate accidents. Common sense is your most valuable asset here.

Most microcomputers are under warranty for 90 days. If there are any deficiencies in the microcomputer itself, they are likely to show up during this period. They should be corrected free of charge.

It is essential to sign a contract for service. If you do not have a service contract, you may have to wait days or weeks for repairs, whether the repair is carried out at your site or at the vendor's service centre.

Maintenance, as a service, is becoming quite competitive. There are a number of large corporations that service a variety of different vendors' equipment. The cost of hardware maintenance varies by vendor, your location and type of contract. As a rule of thumb, if you are within approximately 100 kilometres of a service location, you can purchase an on-site maintenance contract for about 12-15% of the purchase price of your hardware per annum.

Maintenance done at the service vendor's location (referred to as depot, mail-in, in-store, or carry-in) can cost less. However, there are some concerns to keep in mind: turnaround time, hazards of shipping, clear explanation of the failure, etc.

Electro-mechanical devices - the disk drives, printers and keyboards - are the components most likely to break down. If your power fluctuates, your microcomputer's power supply and the printed circuit boards may also fail.

Software Maintenance

With regard to functional packages, any flaws should be fixed by the vendor without charge provided that you are within the warranty period. Beyond this period, your contract with the software vendor should require the vendor to provide minor as well as major enhancements (i.e., software maintenance) to meet your changing information needs. You might, for example, want to modify the format of your tax bill to include additional special area rating information. Such work is usually charged on a time-and-expenses basis. Revised documentation, detailing the changes, is a matter to be negotiated with the vendor. Changes are expensive, which reinforces the importance of the package being as complete as possible.

In the case of generic packages (word processing, etc.), the software vendor who produced the generic package is responsible for software maintenance. This vendor is usually not the retailer from whom you bought the package.

The software producers' usual practice is to fix errors if the program is not performing as documented. There is no charge to licensed users. The producers will supply new releases of the software to licensed users for a fairly nominal charge - generally between 5-20% of the original purchase price. A new release may have enhancements (for example, a spelling checker may be added to a word processing program), and the errors in previous releases should have been eliminated.

DEALING WITH BREAKDOWNS

When an error occurs, or some part of the system fails, the following steps will help to get the microcomputer going again as soon as possible.

1. Write down the specific error message, and note the exact conditions under which the failure occurred. The vendor's service staff will need this information when diagnosing the problem. They will also want to know the equipment serial number.

2. Refer to the error condition codes in your manuals to see if you can determine the cause of the problem.

3. Make sure that all plugs, connections and circuit boards are properly connected, particularly if you have just moved the equipment or installed new devices.

4. Before sending equipment in for repair or having someone sent to your offices, telephone your usual vendor support person. Explain the problem and what you have done to try to correct it. The problem can often be resolved over the phone.

5. If the vendor must see the equipment or programs, obtain a definite commitment as to when the service will be performed.

6. If the failure has not been resolved after two service calls, explain your concern to the vendor's management and ask for a more experienced person to be assigned.

HANDLING DISKETTES

A diskette is simply a round sheet of plastic with a film of metallic oxide that has magnetic properties. The diskette drive has "heads" which read and write (or record) information magnetically on surface of the disk. Unlike the read/write heads in hard disk drives, which travel a few thousandths of an inch above the disk surface, diskette read/write heads ride right on the surface, ultimately causing the diskette to wear out.

If diskettes are to give long service, a few handling tips should be followed.

1. Keep away from extreme heat (+40°C) and cold (-0°C). Extreme temperatures cause the film to warp. Make sure that the diskette is at about room temperature when you use it.

2. Keep away from strong electrical or magnetic sources (e.g., motors, telephone bells, static). These destroy the data on the surface. Do not put the diskette near a magnetic paperclip holder; don't put paperclips on or near the diskette either. They can damage the data.

3. Keep diskettes in jackets, protected from dust, smoke and other contaminants.

4. Don't touch, bend or scratch the recording surface of the diskette.

5. To avoid damaging the diskette's surface, don't write on the diskette jacket with a hard-tipped pen or pencil.

6. Use your diskettes in a cycle so that the same diskettes are not in constant use. Alternating between active and backup use will prolong the diskettes' life.

7. Keep your diskette drives well aligned. Moving the diskette drive equipment can cause misalignment. Ask your vendor and refer to the manuals about any special precautions to be taken when moving the equipment.

8. Don't remove the diskette while the drive is operating (when the red light is on). Doing so can score the surface of the diskette.

9. Avoid buying mail order or lower-priced diskettes unless you know that experienced users are satisfied with their quality.

EXPANDING YOUR SYSTEM

When your microcomputer is being used at more than 80% of capacity most days of the week (i.e., 6 hours in a 7 1/2 hour day, or 8 million bytes of a 10 million byte disk), you will start having overload problems. The symptoms are these: errors caused by operators having to rush to get work finished in the time available; overtime, and equipment or system failures. It is a false economy to try to make your equipment handle a load of more than 80% of capacity. The costs (direct and indirect) of overloading a system are far higher than the cost of buying the additional equipment needed.

The growth solutions available for single-terminal microcomputer systems are outlined overleaf.

TABLE 4

ACCOMMODATING GROWTH

PROBLEM	ALTERNATIVE SOLUTIONS
NOT ENOUGH TIME AVAILABLE	• BUY A FASTER PRINTER • CONVERT FROM FLOPPY TO HARD DISK • DISCONTINUE MARGINAL APPLICATIONS • BUY A SECOND MICRO, OR UPGRADE TO A MULTI-TERMINAL MICRO OR LOCAL AREA NETWORK OR TO A MINICOMPUTER
NOT ENOUGH DISK STORAGE	• OFF-LOAD SELDOM USED FILES AND PROGRAMS TO BACK-UP • BUY LARGER DISKS • DISCONTINUE MARGINAL APPLICATIONS

If you decide that your municipality has outgrown a single-terminal microcomputer system, you will find it useful to read Microcomputers in Local Government: A Manual, which deals with the more complex microcomputer systems.

CONCLUSION

Taken separately, none of the issues discussed in this section will make or break your microcomputer operations. But considered together, the issues will have a big impact on how successful your first microcomputer will be.

9 - FUTURE TRENDS

The rapid growth in the use of microcomputers leads prospective first-time buyers to draw opposite conclusions. Some people respond with: "I'd better buy one and learn how to use it as soon as possible". Others take the view that "things are changing so rapidly, I had better wait and see how the microcomputer industry shakes out before I try to use this new technology."

Both points of view seem to have merit. There are undeniable benefits to be gained from installing a municipal microcomputer. On the other hand, the "wait and see" approach is also justified on the face of it: hardware and software are going to improve in quality, performance and ease of use - and all at a lower cost.

The trouble with this latter approach is that you could "wait and see" permanently. The technology will not stop changing and improving. By delaying the purchase of a microcomputer simply on the grounds that anything you buy today will be obsolete tomorrow is to miss the point. There are two overriding questions: Will you get a payback from the equipment that is available now, and will the equipment serve your purposes? If the answer to both questions is yes, then it does not matter that more advanced models are coming along all the time. Therefore, the purchase of a microcomputer need not be postponed on the grounds of potential obsolescence. You may delay the purchase on other grounds - your preliminary investigation may show that a microcomputer is just not practical for your municipality right now.

What does the accelerating change in technology mean to you as a potential first-time microcomputer user or as a microcomputer user a couple of years down the road? This question is dealt with from the perspectives of obsolescence, the marketplace, technology, and the evolving role of microcomputers.

OBSOLESCENCE

As a potential user, you should go with the vendor who offers the application software that most closely meets your primary applications requirements.

As a current user who has achieved a payback from your microcomputer, you need not be concerned that your microcomputer has become or may soon become obsolete. Upgrading to more advanced equipment should be considered only as the newer applications and capabilities will pay for themselves.

MARKETPLACE

Many industry observers think that IBM, IBM-"clones" (microcomputers that are compatible with IBM systems and software in varying degrees) and Apple will dominate the general-purpose microcomputer market - primarily because of the amount of software available for them. Other vendors are predicted to be successful only if they have unique, proprietary application software to meet the needs of markets that the major vendors do not consider attractive.

The municipal market seems to reflect the approach recommended in this Guide: that application software is the first consideration. The hardware being purchased by municipalities is equipment that can run the chosen software. This hardware may or may not be a dominant make. Its "popularity" is not and should not be a concern to the small municipal user. Popularity should be taken into account only if the chosen software can run on several different makes of microcomputer, and even then there are more important concerns - vendor support, maintenance, reliability and the like. Popularity in the general marketplace does not automatically guarantee good support in a specific marketplace (i.e., small municipalities). Nor is popularity necessarily a reliable indicator of the vendor's stability or his commitment to the market.

TECHNOLOGY

Microcomputer vendors will develop new applications and functions to take advantage of the increased capacity, capability and economy of the hardware. An increasingly wide range of generic packages will become available. Many of these packages will be designed to process text (words) as opposed to numbers (data).

Tomorrow's office microcomputer will be slightly smaller and cheaper but much faster, much more powerful, and reliable, and much easier to use. Microcomputer systems will also integrate office technologies that are currently separate, such as telephones, photocopying/ facsimile, video, micrographics, etc.

THE EVOLVING ROLE OF MICROCOMPUTERS

The microcomputer will become a primary office tool. It will be used both as a standalone microcomputer and as a terminal linked to a mainframe or a minicomputer, or to a local area network (LAN). The LAN will connect it to other microcomputers or to office equipment such as word processors or photocopiers.

It will also be possible to connect it within seconds to:

- local area networks of other agencies (e.g., police) or of regional governments
- remote mainframe networks (government ministries such as Municipal Affairs and Housing, Revenue, and Environment, or large municipalities)
- public data banks, such as Info Globe, or Queen's University.

In time, even the smallest municipalities will probably want to be linked to a local area network or to remote networks of one kind or another. If all this seems far-fetched, ask someone who was born in 1900 what he thought of telephones in 1910, or automobiles in 1920, or airplanes in 1930, or tabulating equipment in 1940, or television in 1950, or computers in 1960.

APPENDIX A
GLOSSARY

The Glossary lists words that appear in the text of this Guide and the Workbook, as well as some words that don't. All are words that you are likely to encounter in reading about and using microcomputers.

ACCESSORY see Peripheral.

ACOUSTIC COUPLER A modem into which the telephone handset is inserted during transmission of data between computers.

ADDRESS The means of identification by which the CPU 'recognises' a location in the computer's memory. The address is usually a number. Also used as a verb, e.g., the CPU addresses the memory, meaning that the CPU indicates a specific location.

ANALOG Refers to the measurement of the performance of something that varies and the use of a continuously varying electrical signal to represent the thing being measured. The varying voltage of the electrical signal is analogous to the quantity being measured, hence the term 'analog'. Contrast with Digital.

APPLICATION An activity or task that can be carried out by a computer (the computer can be applied to the activity or task). Often used as a synonym for the term 'program'.

APPLICATION PROGRAM A computer program that applies the computer to the user's needs by carrying out a task that the user wants performed, e.g., word processing programs, tax billing and receivables programs, etc.

APPLICATION WORKLOAD The overall amount of work the computer is expected to perform, considering all the applications that the user plans to run on the computer.

APPLICATIONS SOFTWARE The collective name for the class of computer programs that are designed to carry out specific tasks, e.g., processing the payroll, accounts receivable, general ledger.

ASCII (AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE) A worldwide standard computer and communications code for representing characters. The code specifies combinations of 7 bits, to represent 128 letters, numbers, or symbols. ASCII is used by most microcomputers and minicomputers and some mainframe computers. See also EBCDIC.

ASSEMBLER A special programming language that converts instructions written in an English-like form into machine-language instructions.

ASYNCHRONOUS Refers to the transmission of data in a manner that does not require the sending and receiving devices to be synchronized. Each character to be transmitted is separated from the next character by a start and a stop bit. There may be pauses between the transmission of one character and the next. Asynchronous data communication is thus comparatively slow, usually running at speeds between 300 and 1200 bits per second.

AUDIT TRAIL Records created during the processing of information so that items can be traced to their source, and the processing steps can be verified.

BACKUP Equipment, files and procedures that are available if the original units are destroyed. May also refer to an operator who takes over when the regular operator is not available. Used as a verb to mean the process of making a duplicate copy of stored data or programs as a safety precaution.

BASE PACKAGE see Package.

BASIC (BEGINNER'S ALL-PURPOSE SYMBOLIC INSTRUCTION CODE) A fairly straightforward programming language, used frequently by programmers to write microcomputer and minicomputer application programs.

BATCH PROCESSING Input items, e.g., invoices, are accumulated over a period of time and are then processed as a batch during one machine run. Unlike interactive processing, the operator usually does not communicate with the program during batch processing.

BAUD The unit for measuring the speed with which data are transmitted between computer devices. 300 baud means that 300 bits of data (or about 30-38 characters) are transmitted per second. Common rates are 300 and 1200 baud for slow-speed telephone communication between a micro and other computers.

BINARY A numbering system in which each digit represents a power of two. (In contrast, a decimal digit represents a power of 10.) In binary, all digits are either 1's or 0's. Thus, the decimal number 8 is "translated" into binary as 1000, decimal 4=binary 100, decimal 2=binary 10, etc. Binary is the numbering system used by most computers.

BIT Abbreviation of binary digit, the smallest unit of information that a computer can read and understand, represented in binary form as a 1 or a 0. It takes 7 bits to represent a decimal digit or an alphabetic character using ASCII codes. In ASCII seven bits=1 byte. An eighth bit, called a parity bit, is usually added. (Bits are further explained in Section 2.)

BOOT To get the computer ready for use by loading the operating system. A "bootstrap" program, usually found in ROM, loads the operating system into RAM from disk. The operating system then takes over control of the computer's operations.

BUFFER A storage area used to hold data until it can be used. The buffer is used to compensate for differences in the rates of data flow or in the timing of transmission of data between input/output devices.

BUG An error in the logic of a program or a malfunction in the hardware. See also Debug.

BUS The signal path or "highway" that carries data and instructions flow in the form of electrical signals from one of several sources to one of several destinations. There are three types of bus: a data bus which carries data, an address bus which sends addresses or locations of data, and a control bus which carries signals controlling the flow of data.

BYTE A group of (usually) eight bits of data which the computer handles as a unit. A byte is used to represent one character, and is, for most purposes, the smallest unit on which the computer operates.

CAPABILITY The state of being capable of doing something. With regard to computers, capability refers to all the things that the computer is capable of doing as a result of its degree of technical sophisticatedness, e.g., sharing files among two or more users concurrently or handling two terminals. Capability thus refers to the range of technical functions the computer is capable of carrying out. Sometimes called "richness of function".

CAPACITY Denotes the amount a computer can handle. With regard to memory, capacity means the amount of data or the size of the program that the internal memory can store at any one time. With regard to the printer, capacity means the number of characters or lines a printer can produce in a given time. Thus, capacity, in contrast to capability, usually refers to some aspect of the computer's performance that can be measured.

CARD A printed circuit board (PCB) that contains the computer's electronic components, e.g., chips, and the electronic circuits needed to connect them. The card is plugged into the motherboard, or main hardware board of the microcomputer.

CASSETTE Small, limited-capacity tape unit used as a storage medium for programs and data files on home microcomputers. Cassettes, like audio tape cassettes, are too small, slow and unreliable to be used for office microcomputer applications.

CENTRAL COMPUTER Used in this Guide to refer to a computer used as a central resource to perform corporate or organization-wide functions, e.g., accounting, payroll, etc. Compare with Personal Productivity Tool.

CENTRAL PROCESSING UNIT (CPU) The microprocessor, located on the motherboard or main PCB, that performs arithmetic, logic and control operations. It also includes an instruction decoder, program counter, clock, and other elements. (Further discussed in Section 2.)

CHARACTER A single letter, number or symbol. May also be called a byte, since one character is represented by one byte or eight bits in most microcomputers.

CHARACTERS PER SECOND see CPS

CHIP (OR INTEGRATED CIRCUIT) A small silicon wafer that contains from a few dozen to tens of thousands of electronic circuits for storing and processing information. The chip is housed in an integrated circuit. There are microprocessor chips and memory chips. (See Section 2 for further discussion.)

CIRCUIT Any path along which electricity can flow. In a computer, a circuit is an electronic device that performs a predetermined function.

CLOCK A device resembling a clock controls the timing of the electrical pulses through the CPU and other computer components. The signals it sends are measured in megahertz (MHz), or millions of cycles per second. The higher the clock speed, the faster the rate at which the CPU can process instructions.

CLONE Used to refer to computers that are designed by their manufacturers to resemble some other make of computer. Clones are compatible in varying degrees with the computer being emulated or with programs written for that computer.

COBOL (COMMON BUSINESS ORIENTED LANGUAGE) An acronym for a programming language widely used for business applications. Instructions in COBOL are much like English and therefore readily understandable.

CODE Symbolic representation; often used as a "shorthand" way of referring to computer program instructions, e.g., "That programmer writes good code (i.e., programs)".

COMMAND An instruction to the computer, e.g., Go to. Some keyboards have command keys, for frequently used instructions, e.g., print. A command may call a few lines of program instructions, an entire program, or a group of programs.

COMPATIBILITY The ability of two or more things to be used together. Compatibility exists between two computers if programs and data can be run on both without any changes having to be made. Also used to refer to the ability of various hardware components (e.g., input/output devices and the computer) to be used together.

COMPILER A complex series of programs that "translates" program instructions written in a high-level, English-like programming language (called the source program) into machine-language instructions. Each programming language requires its own compiler, unless the language is interpreted. (See Interpreter.)

COMPUTER Used in the Guide to refer to a general-purpose device that can process large volumes of data electronically, has a central processing unit and input/output devices, and is controlled by a series of predetermined instructions called a program. (Further explained in Section 2.)

CONFIGURATION Several pieces of equipment make up a working computer installation - the central processing unit (CPU), input/output (I/O) devices such as disk drives, storage and so on. The particular combination of pieces of equipment in a given installation is known as its configuration.

CONSOLE The computer component from which the operator controls the actions of the computer, normally consisting of a keyboard and a CRT.

CONVERT To change from one form or state to another. For example, the manual procedures for carrying out a function may be converted to computerized procedures. The entire process of changing the procedures is referred to as conversion. An organization may also convert its computer installation, meaning that a major change is made, moving from, say, a microcomputer to a minicomputer or from using a service bureau to an in-house microcomputer. See also Parallel Conversion.

CORPORATE FUNCTIONS Refers to the functions that are organization-wide or central to the organization as a whole, e.g., accounting, payroll, etc. Corporate functions may be contrasted with the departmental or specialized functions, such as planning, that exist in larger municipalities. (The use of microcomputers for departmental functions is not dealt with in this Guide. Refer to Microcomputers in Local Government: A Manual.)

CP/M (CONTROL PROGRAM FOR MICROCOMPUTERS) An operating system manufactured by Digital Research Inc. used in many microcomputers. Some computers require special cards to operate CP/M. CP/M is widely used as the operating system of 8-bit microcomputers.

CPS (CHARACTERS PER SECOND) The rate at which slower-speed printers produce output. They print only one character at a time. Compare with LPM. (120-150 cps is equal to 50-60 lines/minute or a full page of computer printout.)

CPU see Central Processing Unit.

CRASH Slang for a computer breakdown. See also Head Crash.

CRT (CATHODE RAY TUBE) A video display device resembling a television screen, on which information is displayed. It is linked to the keyboard and to the central processing unit. CRT is often used as a synonym for 'terminal', thus referring not only to the display device but also to the keyboard. Video display terminal (VDT) and video display unit (VDU), and monitor are synonyms for CRT.

CURSOR A pointer or marker on a CRT that indicates the position on the screen where the next input character will be displayed.

CUSTOM PROGRAM A non-standard or custom program is one specially written to meet the particular needs of one user.

DATA Any information that the computer receives as input, processes in some way or stores, and outputs via a screen or printer. Data may consist of letters, words, numbers, or symbols.

DATA BANK A large collection of computer-based records or files, accessible to the public for a fee, containing, for example, stock prices, or legal precedents, or statistical data about the economy.

DATA BASE A collection of files stored in the computer in such a way that information can easily be accessed, retrieved or re-arranged. A data base contains information on a particular topic or topics, e.g., a financial data base would include files on the chart of accounts, the general ledger balances and the financial posting details. An integrated data base seeks to store each piece of information only once, regardless of where it comes from or how it is to be used.

The hierarchy for organizing information in a data base is as follows: the data base consists of files; each file contains related records, e.g., a record for each tax payer's account; each record is divided into fields or data elements; each field contains a group of logically related characters or bytes, e.g., a taxpayer's name. See File; Record; Field.

DATA BASE MANAGEMENT SYSTEM (DBMS) A comprehensive and generally very complex program for accessing, reading, controlling and maintaining large, integrated data bases.

DATA BASE PACKAGE A packaged program that allows the microcomputer user to store information, arrange it in a chosen order, search it, update it, display it and print it out. (Such packages should not be confused with Data Base Management Systems). Simpler versions of data base packages are sometimes called file managers. They usually manage only one file at a time. Inquiry packages are another type of data base package, enabling the user simply to request information from the computer. Templates are available for some data base packages. See Template.

DATA COMMUNICATION The transmission of coded data by electrical signals over any one of a variety of media, e.g., telephone lines, co-axial cables, microwave, satellites.

DATA ELEMENT see Field.

DATA ENTRY The activity of putting data into the computer by means of an input device (usually a keyboard).

DATA PROCESSING see Electronic Data Processing.

DBMS see Data Base Management System.

DEBUG The activity of solving problems caused by errors or omissions in a program or malfunctions in the computer hardware. (See also Bug.)

DECISION SUPPORT SYSTEM A series of application programs that are used to analyse alternatives to help an individual make a decision, e.g., spreadsheet and modelling packages.

DEGRADATION The slowdown in the computer's response time because the computer has been overloaded by the operator trying to do too much work concurrently.

DENSITY The number of units of information that can be packaged into or stored within a given physical dimension on a magnetic storage medium, e.g., 1600 bits per inch.

DESKTOP COMPUTER A microcomputer used for office purposes with all hardware components normally being located on top of a desk. "Desktop" distinguishes these microcomputers from "portable" microcomputers that can be used anywhere and normally weigh under 30 pounds (excluding a printer). Desktop computers can be moved, but are not readily portable.

DEVICE A piece of computer equipment (e.g., disk, printer, modem).

DIAGNOSTIC A program designed to check the operation of a computer component or a program for errors or malfunctions and to report its findings via a message.

DIGITAL Refers to the representation of information by means of binary digits (1,0) and the use of discrete electrical signals to represent these digits. Contrast with Analog.

DIRECT ACCESS see Random Access.

DISK (OR DISC) A means of storing data magnetically on a device a that looks much like a gramophone record. The data on the disk can be retrieved randomly. See Diskette; Hard Disk; Random Access.

DISK DRIVE A device which holds the disk and rotates it. (Diskettes have to be inserted into it). The disk drive is linked to the computer, enabling information on the disk to be transferred to the computer and information from the computer to be recorded on the disk. Further explained in Section 2.

DISK OPERATING SYSTEM see DOS.

DISKETTE, OR FLOPPY DISK A small, flexible disk that stores information or data magnetically. Floppy disks vary in size: 3"-3.9" (micro-floppy), 5 1/4" (mini-floppy) and 8" (floppy). Capacity varies from 100KB to 1,200 KB. (Further described in Section 2.)

DISPLAY DEVICE (OR UNIT OR SCREEN) Synonyms for the CRT.

DISTRIBUTED DATA PROCESSING The use by an organization of more than one computer in more than one location to carry out the organization's data processing. Thus, the data may also be stored in more than one place. The computers are linked by communications lines. This decentralized approach can be contrasted with the use of a single computer in a single location, or centralized processing.

DOCUMENTATION A collective name for all the documents (written records) that give information about something, e.g., the operation of a microcomputer, or all the instructions that together make up a program. To document means to record something in writing. A computer's documentation usually means all the literature provided with the equipment to assist the purchaser in using it.

DOS (DISK OPERATING SYSTEM) A program that controls the microcomputer and enables the application programs to interact with the hardware devices (particularly the disk) so the data can be moved, stored and processed. Used in computers that employ disks as the mass storage medium. Some computers have a built-in DOS; others require a DOS to be loaded into the computer memory from disk before application programs are loaded.

DOT-MATRIX PRINTER An inexpensive printer that creates characters by combining dots. (Further explained in Section 2.)

DOWNTIME The period during which a computer is not functioning, usually because of a hardware or software problem.

DSS see Decision Support System.

DUMP To transfer the contents of the computer's main memory to a peripheral device (the printer or the disk or the CRT).

EBCDIC (EXTENDED BINARY-CODED DECIMAL INTERCHANGE CODE) A standard communications code, used primarily by IBM mainframes and minicomputers, employing 8 bits and capable of representing 256 characters or numbers. An IBM micro computer uses ASCII codes. When a microcomputer communicates to an IBM mainframe or mini, the ASCII codes must be converted or translated to EBCDIC codes.

EDIT To look for errors, which the user then corrects. The data are then ready for further processing.

EIGHT BIT See Word.

ELECTRONIC DATA PROCESSING The electronic processing of data by a computer, including input, calculations, storage and output. (Data can, of course, be "processed" in many other ways - the human brain processes data continuously.)

ELECTRONIC MAIL A means of sending messages electronically, via computers that can communicate with each other.

ELECTRONIC SPREADSHEET An interactive computer program that allows the user to use the CRT as a spreadsheet. The program provides a grid of columns and rows. The relationships between the data to be entered in the columns and the rows can be specified by the user. The program then manipulates the columns and rows of numbers automatically. If one number is changed, all other related numbers are automatically changed. Spreadsheet programs thus require the user to do a fair amount of preliminary work. Templates are available for some spreadsheet programs. See Templates.

EPROM (ERASABLE PROGRAMMABLE READ ONLY MEMORY) This type of Read Only Memory (see ROM) allows a programmer to program part of the ROM. Thereafter, the instructions remain unchanged unless the equipment manufacturer or the programmer decides to change them.

ERGONOMICS The scientific study of the relationship between human beings and machines and the effects of this relationship on human performance. Also known as human factors engineering.

EXECUTE To carry out the instructions in a program, i.e., to run the program.

FACSIMILE A process whereby images are transmitted electronically, usually over some distance. The image is scanned, converted into digital signals, sent via a communications line, and reconstructed as a duplicate of the original image at the receiving station. Sometimes called fax.

FIELD A sub-division of a record, i.e., a group of one or more related characters and/or numbers stored in a computer record. A record will have several fields, e.g., name, address, postal code, and telephone number are fields in a taxpayer's record. See also Data Base.

FIELD UPGRADABLE Refers to a piece of computer hardware or software that can be upgraded at the customer's site without being physically replaced. (Equipment that is not field-upgradable usually has to be disposed of, and completely new equipment has to be purchased to replace it.)

FILE A file consists of collection of related records, e.g., an employee file has a record for each employee. See also Data Base.

FILE MANAGER see Data Base Package.

FIRMWARE The software stored by the computer manufacturer in ROM (Read Only Memory). Some frequently used programs in the operating system are stored in ROM, so the computer will not have to load them from the disk to execute them. The computer can therefore run faster.

FLOPPY DISK see Diskette.

FLOWCHART A pictorial representation of the steps in a program, or of a solution to a problem.

FONT A set of printing type in one particular style (e.g., Helvetica, Pica, Executive, etc.) and size.

FORTRAN (FORMULA TRANSLATOR) An early high-level computer language still in wide use, particularly for mathematical, scientific and engineering applications.

FUNCTION KEY A key that causes the computer to perform a predetermined function, e.g., Help, Delete, etc.

FUNCTIONAL PACKAGE Used in the Guide to refer to packaged programs that carry out organizational functions e.g., the accounting and payroll functions. Such packages are often designed to meet the needs of a particular "sector", e.g., local government, automobile dealers, fast food restaurants, etc. (Packages designed for particular industrial sectors are sometimes called vertical market packages.) Contrast with Generic Package.

FUNCTIONALITY see Capability.

GENERIC PACKAGE Used in the Guide to refer to packages that can be used by any organization of any size, in any industry, e.g., electronic spreadsheet or word processing packages. These packages are sometimes called personal productivity tools or horizontal market packages, i.e., they fit into any industry. Contrast with Functional Package.

HARD COPY A record of computer output printed on paper.

HARD DISK A disk made of aluminum and covered with magnetic metal oxide, capable of storing 5 million bytes or more, sealed in plastic to protect it from dust. Most hard disks cannot be removed from the disk drive, but removable disks are becoming more common. Often called a Winchester disk.

HARDWARE The physical pieces of computer equipment.

HEAD see Read-Write Head.

HEAD CRASH When a read/write head touches a disk spinning at high speed and destroys the data. Usually the result of the head becoming misaligned or a power failure.

HERTZ A unit of frequency equal to one cycle per second. See also Clock.

HEXADECIMAL A numbering system that uses 16 as its base of unit values. (The decimal system uses base 10.)

HIGH-LEVEL LANGUAGES Programming languages that resemble ordinary English. A single instruction in a high-level source language translates into many machine-language instructions.

IC (INTEGRATED CIRCUIT) See Chip.

IEEE 488 A standard produced by the Institute of Electrical and Electronic Engineers for the parallel transmission of data. See Parallel Transmission.

INFO GLOBE A data bank owned by the Globe and Mail that contains articles reported in that newspaper. It is accessible on line to subscribers.

INFORMATION Any data that can be coded for processing; data organized in a meaningful manner that meets a user's needs.

INITIALIZE To get something (a program or a disk) ready for use.

INPUT As a noun, input refers to data that will be processed by the computer. As a verb, to input means to enter data into the computer.

INPUT/OUTPUT DEVICE (I/O DEVICE) A piece of equipment that feeds data into or takes results from the computer. CRTs and keyboards are input devices; printers are an output device. (Further discussed in Section 2.)

INQUIRY A request for information that is stored in the computer's memory.

INQUIRY PACKAGE see Data Base Package.

INSTALLATION A collective name for the hardware, software and other computer-related facilities in an organization. Installing the computer means setting it up in a user location.

INSTRUCTION One line of coding in a program, e.g., Add A and B, telling the computer what to do next.

INSTRUCTION SET All the types of instructions that a microprocessor is capable of carrying out. The microprocessor combines these instructions in different ways to carry out major tasks.

INTEGRATED Applications are said to be integrated if they use common commands and/or common data, or if some of the output of one application is automatically used as input to another. See also Data Base.

INTEGRATED CIRCUIT see Chip. (Further explained in Section 2.)

INTEGRATED GENERIC PACKAGES Software packages that combine several applications. They are capable of carrying out several different tasks using common data. For example, an integrated package may combine a spreadsheet, a graphics program and a data base utility. The output from one task, e.g., numbers produced by the spreadsheet part of the program, is used to carry out another task, e.g., producing graphics.

INTEGRITY The soundness or unimpaired condition of something. For example, the integrity of a computer file refers to its records and data elements being error-free and complete. (Integrity is thus a condition that must be maintained.)

INTERACTIVE A mode of processing that allows the user and the computer to "communicate" with each other. For example, the computer displays a question on the screen, and the user keys in a response, which in turn causes the computer to do something.

INTERFACE A place or point at which two systems meet; in computers, an electronic connection between two computer devices, enabling them to communicate. (This kind of interface is also called a port. See Port.) Also used as a verb to refer broadly to the ability of one thing to interact with another, e.g., the accounts payable program interfaces with the general ledger program.

INTERPRETER A large program that translates an application program written in a high-level language into machine language each time the program is executed. BASIC programs, for example, are usually interpreted rather than compiled. (See Compiler.) Since the instructions must be interpreted each time the program is run, such programs tend to execute more slowly than compiled programs, which are already compiled into machine language.

I/O DEVICE see Input/Output Device.

K (KILO) Stands for about one thousand units. (Strictly, 1,024 or 2 to the power of 10.) Thus 64K = 65,536. 64 kilobytes is written as 64 K bytes or 64KB.

KEYBOARD A piece of equipment that has keys resembling those of a typewriter, used for entering data. (Further discussed in Section 2.)

KEYING The process of using a keyboard to enter data into the computer. Comparable to typing.

LAN See Local Area Network.

LETTER-QUALITY PRINTER A printer that produces fully formed letters, similar to those produced on a typewriter. Compare with Dot-Matrix Printer. (Further discussed in Section 2.)

LIBRARY A collection of programs used by an organization.

LOAD To read a program from an external storage device (e.g., a diskette) into the computer's main memory for execution.

LOCAL AREA NETWORK (LAN) A system that allows computers within a local area (e.g., a single building) to be linked, so that they can share peripherals such as printers and disks, as well as data and programs. LAN's can be configured in several different ways. A network controller keeps order.

LOGON To identify oneself to the computer. A set of procedures that the user must follow in order to gain access to the CPU. For example, it is usual to enter the user's identification code, called the user ID or userid, and possibly a password.

LOW-LEVEL LANGUAGES These programming languages are in a form that requires little or no translation by the machine, e.g., assembly language. In contrast to high-level languages, they do not resemble English. Programs written in such languages can usually be executed faster than those written in high-level languages.

LPM (LINES PER MINUTE) A means of measuring the speed of a high-speed printer which prints an entire line at a time (e.g., 200 to 2,000 lpm). Such printers are not commonly used with microcomputers. Compare with CPS.

M (MEGA) About one million. A 20-megabyte disk stores about 20 million characters or bytes. 20 million bytes is abbreviated as 20 MB.

MACHINE LANGUAGE A binary code that is the microprocessor's native language and therefore requires no intermediate translation. Object programs are written in machine language.

MAGNETIC DISK see Diskette; Hard Disk.

MAGNETIC TAPE A medium upon which data are recorded by means of magnetic dots. Records are stored and read in sequence, i.e., they cannot be accessed directly. See Sequential Access and Random Access.

MAIN MEMORY see Memory.

MAINFRAME A very large computer. (Further discussed in Section 2.)

MAINTENANCE Maintenance is used to refer to computer hardware and software. Hardware maintenance for microcomputers is usually 'remedial', i.e., the micro is repaired when it fails, as opposed to preventive (equipment is serviced at regular intervals).

Software maintenance usually refers to minor modifications of functional programs to accommodate changes in applications. For example, if labour rates change, then a number of payroll programs have to be changed.

MANAGEMENT INFORMATION SYSTEM An integrated series of programs and data files designed to meet most or all of the information needs of a particular functional area of the organization, or of the entire organization. Compare with Decision Support System.

MASS STORAGE The term used to refer to the devices (disks or tapes) for storing large amounts of data. (Further discussed in Section 2.)

MEMORY Usually refers to the main memory, or RAM, of the computer, i.e., the device that stores data and programs, allowing them to be executed by the CPU. Sometimes memory refers to the auxiliary memory of the computer, i.e., disk or tape which is used for mass storage. See also RAM, ROM, Mass Storage. (Memory is described in Section 2.)

MENU A list of options (programs, or parts of programs, or records) which the computer displays on the screen. The user can choose the desired option to carry out a function or to retrieve some information. Menus tend to make the system user friendly for a new operator.

MERGE To combine items from two or more sets of information into a single set.

MICRO Used as a shortform for microcomputer in the Guide.

MICROCOMPUTER A small computer with a microprocessor as its CPU and its major circuitry on chips. (For a description of the basic elements of a microcomputer, see Section 2.)

MICROGRAPHICS The collective name for the photographic techniques of producing records in miniaturized form, e.g., microfiche, microfilm.

MICROPROCESSOR The central processing unit of a microcomputer. Further explained in Section 2.

MIGRATION PATH A series of options offered by a computer manufacturer for upgrading an existing computer system.

MINICOMPUTERS A class of computers that have more processing power and memory than microcomputers but less than mainframes. (Further discussed in Section 2.)

MIS see Management Information System.

MODEM (MODULATOR/DEMODULATOR) A device that allows computers to communicate with each other using telephone lines by converting the digital signals of a computer into the analog signals of a telephone line and vice versa.

MONITOR Another name for a CRT.

MOTHERBOARD The main hardware board of a microcomputer, into which all other printed circuit boards are plugged. (The motherboard itself is a printed circuit board.)

MS-DOS Disk Operating System produced by Microsoft Inc. for 16-bit microcomputers.

MULTI-PROCESSING/MULTI-PROGRAMMING/MULTI-TASKING These three terms tend to be used interchangeably. There is no universally accepted definition for them. If a computer salesperson uses one of these terms, find out whether he or she is referring to:

- a machine that has more than one microprocessor (this is the most common meaning of "multi-processing"). The number of microprocessors has no bearing on how many applications can be run at the same time
- a machine that can run more than one application program virtually simultaneously (it could have one or more microprocessors). This is the most common meaning of "multi-programming"
- a machine that can accept keyboard input while printing output from a previously executed program (spooling). This is a specific version of multi-programming
- a machine that can simultaneously execute two tasks within a single program. This is the most common meaning of "multi-tasking"
- some other capability.

MULTI-USER Refers to a computer that is capable of accommodating more than one operator using the computer simultaneously. Such a computer may have only one microprocessor but several terminals (CRTs and keyboards) and use a multi-tasking, multi-programming or multi-processing operating system.

NETWORK A group of computers and terminals linked to each other by co-axial cables or telephone lines. The network enables computers to send and receive data and to share some devices, e.g., printers and disk drives, with each other. See also Local Area Network.

OBJECT PROGRAM (or OBJECT CODE) The machine language translation of a source program done by a compiler.

OCTAL A numbering system using 8 as a base. No longer in wide use for computer systems.

OEM (ORIGINAL EQUIPMENT MANUFACTURER) A company that buys hardware (it does not manufacture the hardware, even though the name suggests this), writes application software, and then sells the hardware and the software as a complete system. Sometimes called a system house.

OFFICE MICROCOMPUTER Used in this Guide to refer to the equipment used by the small municipality as its sole computer resource.

OFF-LINE Not communicating directly with the computer. A mode of processing that involves an intermediate step before the data is entered into the computer. For example, data may be keyed onto a diskette (off-line). Some time later, the diskette is put on the computer for reading and processing. In a microcomputer that has a hard disk, data and text can be transferred from the hard disk to a floppy disk for storage purposes. Thus the data or text are stored off-line.

ON LINE Communicating directly with the computer and under the control of the CPU and a program. A mode of processing that permits data to be entered directly to the computer, changing the data base immediately. Similarly, information is received immediately from the computer. Anything that is stored on a hard disk in a microcomputer system is stored on-line.

ON SITE At your location, e.g., training or maintenance may be conducted on site.

OPERATING (OR SYSTEM) SOFTWARE The programs that are necessary to keep the computer running as automatically as possible. They do not actually process anything - that is the job of applications software - but they monitor and perform many operations at speed far beyond the capabilities of a human operator. Operating software comprises the operating system, the assembler, compiler or interpreter, and utility programs.

OPERATING SYSTEM A group of programs that, among other things, control the computer's internal operations and input/output devices, interpret programs, interface the data from application programs to the hardware and schedule hardware resources. (Further discussed in Section 2.)

OPERATOR The person who operates the computer, looks after libraries of files and programs, and checks paper or other input/ouput media. In the case of microcomputers, the operator may also be the user, i.e., the person who inputs data and makes use of the microcomputer's output to do his or her job.

OPERATOR MANUAL Written instructions for the person who actually operates the computer.

OUTPUT The results of processing data. Output may be in machine-readable form, such as magnetic tapes or disks, or may be in human-readable form, such as computer print-outs or displays on the CRT.

PACKAGE A program or set of programs, available from the computer manufacturer or a software company, designed to process a particular type of application. Since software packages are "pre-programmed", they can save a tremendous amount of time, and effort in design, programming, testing and documentation. But since they are standard (i.e., designed to meet the common or usual requirements), they may not do exactly what a particular user wants. To be truly considered a package, the program must have been thoroughly tested and debugged. It should also be capable of being used without major alteration by a class of users (e.g.,

4. Municipal Information Systems Association (MISA)

The prime aim of MISA is to encourage the free exchange of information and expertise among members of the local government electronic data processing community. They want to foster awareness and knowledge about the use of computers among users, managers, executives and councils.

MISA members are generous with help and advice to the non-technical people, particularly those just getting their feet wet. They also provide a forum for technical people to exchange ideas and experiences on new technologies.

You may want to become a member of MISA. Max Harris, Regional Municipality of Hamilton-Wentworth at (416) 526-4295, is Chairman of MISA for 1984. Or you can write to:

P.O. Box 1188
Station B
Burlington, Ontario
L7P 3S9

5. Other Associations

Other Ontario municipal associations can be of help as well. They include the political and professional organizations listed in the annual Ministry publication, the Municipal Directory.

In addition, the Ontario Municipal Management Development Board (OMMDB) has publications and training resources available to municipalities.

There are also several U.S. municipal associations that offer services (mostly publications) to their members. They are the International City Management Association (ICMA), the Municipal Finance Officers Association of the U.S. and Canada (MFOA) the Urban and Regional Information Systems Association (URISA), and the International Institute of Municipal Clerks (IIMC). They are described in the publication Microcomputers in Local Government: A Manual.

The International City Management Association is presently developing microcomputer programs designed specifically for municipal government. The following new products were announced in March 1984:

Available :
- Records Management System
- Minute Minder System
- Microfilm Retrieval System
- Financial Trends Monitoring System

Under Development:
- Public Works Work Order System
- Police Dispatch Support System

6. Vendors

Vendors can supply you with information and literature about their products. Using the checklists and working tools provided in the Workbook, you will know what questions to ask them. The hardware vendor should be able to advise you about generic and other software packages that will run on his equipment, and the accessories that are available.

7. Computer Magazines

A good way of keeping up with developments in microcomputers and the ways in which they are being used is to read popular computer magazines. The articles in these magazines generally do not set out to teach you the basics, but they do explain new concepts as they come along. They also give you a feel for the marketplace small municipalities), and should be properly documented. To be considered a proven package, the package should be successfully installed at two or more user sites. A base package is a standard package that can be modified more or less extensively to meet a particular user's requirements. (The package is written with the intention of being used in this way.) See also Functional Package, Generic Package.

PARALLEL CONVERSION A parallel conversion is one in which the old system is maintained while the new, computerized system is being installed and tested, to verify that the new system is producing the results it is supposed to produce.

PARALLEL TRANSMISSION The transmission of one byte at a time over a line, with each of the bits following a separate path. Normally conforms with the standard IEEE 488, which specifies the connector, control circuitry and electrical signals.

PARITY BIT An extra bit, sometimes used with a byte of data to verify the correctness of the coded contents of the byte. Thus the parity bit makes it possible to detect errors in the coded data.

PASCAL A high-level programming language used for business and scientific programs.

PASSWORD A secret set of characters that should be known only to authorized people. The password must be entered before access can be gained to the computer.

PCB see Card.

PERIPHERALS (OR PERIPHERAL DEVICES) A collective name for the equipment that is attached to the computer to perform input, output or storage functions, e.g., keyboards, CRTs, disk drives, printers. The peripherals are external to the CPU and main memory but are under the CPU's control to a lesser or greater degree.

PERSONAL COMPUTER In the early days of microcomputer technology, microcomputer computers had very limited power. They were expected primarily to be used by and to serve the needs of one person, hence the term 'personal computer'. Microcomputers are still used to meet the needs of one person, but so-called personal computers are now powerful enough to be used as the sole computer resource for a small organization. This Guide avoids the use of the term 'personal computer'. Instead, the term 'office microcomputer' or 'microcomputer' is used. Contrast with Personal Productivity Tool.

PERSONAL PRODUCTIVITY TOOL Used in this Guide to refer to the use of a microcomputer to increase the productivity of one individual, e.g., running a spreadsheet program, in contrast with using the computer to carry out corporate functions such as accounting.

PIRATE To give away or sell copies of software products without paying the producer or the licensed distributor of the product. Piracy is illegal. In contrast, programs in the public domain may generally be freely copied.

PIXEL Abbreviation of picture element. A pixel is a small dot of light used on the CRT's screen to form images. The greater the number of pixels, the higher the resolution of the image.

PL/1 (PROGRAMMING LANGUAGE #1) A compiled programming language developed by IBM for mainframe computers.

PLOTTER A device that draws graphs, pictures or schematics. The pen or other drawing instrument operates under the control of the computer.

PLUG COMPATIBLE The ability of one device to link directly with another without any alterations to either device. (First-time computer users should be extremely cautious about vendor claims of hardware (or software) compatibility.)

PORT Ports (or interfaces) allow data to pass to and from the computer and its peripherals. Externally, the port takes the form of a sophisticated electrical plug, with several pins, which connects the peripheral's cable to the computer unit. Internally, the port's circuits recode the signals so that the receiving or sending element can understand them. The RS 232 serial port is the most common form of interface. There are also parallel ports. See Serial Transmission; Parallel Transmission.

PORTABILITY The ability of a program to be used on different makes of computer.

PRINTED CIRCUIT BOARD see Card.

PRINTER A peripheral device that converts coded data into printed form, thus functioning as a robot typist. See also Dot-matrix printer; Letter-quality printer; CPS; LPM.

PROCESSING A series of actions or operations intended to produce a result. A computer processes data in accordance with programmed instructions.

PROGRAM A set of instructions directing the computer to perform a task. The normal sequence of instructions is the following: read information; process it (add, subtract, etc.); update existing files with new information; and output (display, print or store) information. Also used as a verb meaning to compose such a set of instructions.

PROGRAMMER A person who writes a program in the code of a particular programming language. In doing so, the programmer translates input and output requests, logic flows and calculations into a set of computer instructions.

PROGRAMMING LANGUAGE A systematic code used for writing the instructions that together make up a program. BASIC, FORTRAN, COBOL and PASCAL are examples of widely used programming languages, each with its own symbols, "grammar", spelling rules, and so on. Languages come in different versions. Thus, BASICA is similar, but not identical, to BASIC.

PROMPT A word or phrase that appears on the screen asking the operator to enter certain information, e.g., Enter data.

PROTOCOL A set of rules, formats and practices governing data communications between computers and terminals. Protocols determine such things as how to verify accuracy, and address messages, as well as the number and types of information and devices that can communicate.

PULSE An electrical signal, the presence or absence of which represents data to a computer.

PURGE To remove unwanted data or data files. For example, draft documents are usually purged from the computer storage medium after the final document has been approved.

RAM (RANDOM ACCESS MEMORY) The main, internal memory of the computer, into which programs and data are entered for processing during the actual execution of the program(s). (Further discussed in Section 2.)

RANDOM ACCESS (or DIRECT ACCESS) A method of accessing that allows the computer to go directly to a stored data record without having to read an entire disk or tape compare with Sequential Access.

RANDOM ACCESS MEMORY see RAM.

READ A computer "reads" data by sensing the magnetized dots on a disk or diskette, or the electrical pulses on a communication line.

READ-WRITE HEAD Part of the disk drive that reads and writes on the concentric tracks of a disk. (Further discussed in Section 2.)

RECORD A collection of related data items; a logical unit of information concerning a unique entity, e.g., all the information pertaining to one taxpayer's account - name, address, balances outstanding, etc. Each record usually has a unique identifier, or key, by which the system can identify it, e.g., the taxpayer's account number. See also Data Base.

RECOVERY The re-starting of a system after it has been out of action as a result of a malfunction or an error condition.

RESPONSE TIME The interval between entering data into a computer and receiving a response.

RFP (REQUEST FOR PROPOSAL) A formal document requesting vendors to submit proposed solutions to an organization's (computer) requirements. May also be called an RFQ (Request for Quotation).

RICHNESS OF FUNCTION see Capability.

RISK The potential loss or damage to an organization that could occur if a computer system does not function properly or is misused.

ROM (READ ONLY MEMORY) An internal memory holding permanent instructions for the computer, not changeable by the user. (Further discussed in Section 2.)

RPG (REPORT PROGRAM GENERATOR) A high-level programming language used for business applications, particularly to format and print the results of data-processing programs.

RS232 OR RS232C A standard specified by the Electronics Industry Association for the physical connections between computers and other devices (e.g., modems or printers) for the serial transmission of data. The standard specifies the number of pins on the connector and types of control circuits and electrical signals that will pass through the connection. See also Port; Serial Transmission.

RUN The series of activities that the computer carries out to complete a processing task (e.g., the tax billing run).

SAVE A command that tells the computer to store data or a program that are to be used again.

SCREEN The television-like screen of a CRT.

SCROLL To move data or the cursor up or down on a screen.

SECTOR The unit into which the surface of a hard disk or a diskette is divided for formatting the disk for storage purposes. If the disk is thought of as a pie, the sector is the equivalent of a slice of pie. There are usually 8 or 9 "slices" or sectors on a diskette. In most microcomputers, a sector contains 256 characters or bytes.

SECURITY Refers to protecting the microcomputer hardware, software and documentation from theft, misuse or physical damage, as well as safeguarding the information that is stored and processed by the computer. Information must be protected against unauthorized access, modification or destruction.

SEQUENTIAL ACCESS A method of accessing that obliges the computer to read all the stored data in sequence, until it reaches the required data record. Records are also placed into storage in the computer in a specific sequential order.

SERIAL TRANSMISSION The transmission of one bit of data at a time over a line. Serial input/output is usually performed in accordance with RS-232C. Contrast with Parallel Transmission.

SERVICE BUREAU A service bureau is a facility that provides processing, programming, or other services to people beyond the organization that owns the facility. Thus it includes organizations that are solely in the computing business, commercial enterprises that charge outsiders for the use of excess capacity, or government agencies that permit others to use programs and/or computers.

SINGLE TERMINAL see Terminal.

SIXTEEN-BIT (16-BIT) The width of either the internal or external data path of a 16-bit microprocessor. See also Word.

SMALL BUSINESS COMPUTER A microcomputer or a minicomputer capable of performing as a small organization's central computer.

SOFTWARE A generic name for computer programs and their supporting documentation. See also Applications Software and Operating Software.

SORT To arrange records in a particular sequence, e.g., by date due, by amount owed, etc.

SOURCE PROGRAM (or **SOURCE CODE**) A program written in a high-level language by a programmer. This program is translated by the compiler or interpreter into machine language. The machine-language version is called the object program.

SPOOLING (SIMULTANEOUS PERIPHERAL OPERATION ON LINE) A technique whereby output data to be printed are temporarily saved on disk. The operator instructs the printer to start printing once the processing has been completed, and can carry on with other tasks using the microprocessor while the output is being run off on the printer. Spooling allows two or more users to request the use of the printer simultaneously without having to wait for each print program to execute completely in turn.

STANDALONE Refers to a computer (or some other type of equipment such as a word processor) that functions independently as a self-sufficient unit. A standalone microcomputer is thus not linked to any other computer or to any network.

STOCK TAB Continuous-feed paper for everyday use on a printer. The paper has no letterhead or special columns, etc.

STORAGE Storage is the physical means of storing data and programs, either in the main computer or on auxiliary devices. Storage media include paper tapes, and magnetic tapes and disks. (Further discussed in Section 2.)

STREAMER TAPE A magnetic tape used for backing up a hard disk. The technique of streaming speeds up the transfer of data by eliminating gaps between blocks of data that occur with other recording methods. A streamer tape is a faster and more reliable means of backing up a hard disk than ordinary audio cassette tapes.

SYSTEM A system in general means a group of related activities. Here it is usually used as a short form for "computer system". Depending on context, it refers to the combination of hardware that constitutes a particular configuration, or an application that uses the computer as part of the overall system, or the hardware and software together.

SYSTEMS ANALYSIS The analysis of an activity or series of activities to determine exactly what must be accomplished and how to accomplish it.

TAPE see Magnetic Tape.

TELECOMMUNICATION The transmission of data between computer devices over long distances, usually via telephone lines.

TEMPLATE Two types of templates are available with some application packages. A keyboard template, made of cardboard or plastic, can be fitted over the keyboard. The template shows which keys do what when the application is being run on the computer. The second type of template may be part of a computer program or it may be available on a separate diskette or as a book. It sets out the steps to be followed when using interactive programs such as spreadsheets or data bases, in order to achieve a particular result, e.g., you can produce an annual budget using a budget template for a spreadsheet package.

TERMINAL A generic name for any piece of equipment that enables people to communicate with a computer, either directly or from a remote location. Thus terminals are input/output devices. 'Terminal' is used to refer to the CRT and the keyboard considered together; however, a terminal could also consist of a keyboard and a printer. A microcomputer may have a single terminal (one CRT and one keyboard) or two or more terminals, i.e., it may be a multi-terminal microcomputer. With only one terminal, the microcomputer can obviously be used by only one person at a time. A microcomputer could be linked to a mainframe, in which case the microcomputer's terminal serves both as a terminal to the mainframe and as a terminal to the microcomputer itself.

THROUGHPUT The amount of information that a computer can process in a given time. One way of measuring a computer's capacity (e.g., this computer throughput is 200 cheques per hour).

TRACK A concentric ring on a disk. Data are stored on the disk in concentric rings or tracks.

TURNKEY Used to refer to a system installed by a vendor for which the purchaser has only to "turn the key"; a system that theoretically, at least, requires no further modifications or programming by the user.

TUTORIAL DISKETTE A diskette that the user can sometimes obtain from a hardware or software vendor which explains how to use the equipment or the program. It is intended for self-study.

UPDATE The addition to, deletion of, or changes to data that bring the data or program up to date. (Used as a noun or a verb.)

UPGRADE To enhance or expand a computer installation. In contrast with a conversion, the existing facility itself is not altered. Instead, a disk drive or other components may be added. Upgrading software means adding new features to the software. As a noun 'upgrade' refers to the enhancement itself.

USER FRIENDLY Used to describe hardware or software that people who are not data processing professionals will supposedly find easy to learn. 'User friendly' software, for example, might include menus of options, prompts, help features and so on. The commands are self-explanatory, e.g., Save.

USER MANUAL A documented description of a system or application together with instructions so that users can work with it. User manuals should describe all the non-computer activities as well as how to use the equipment, handle the input/output devices and run the programs. They should also contain samples of forms.

USERS The people who make use of the computer system to carry out functions for which they are responsible. In the case of a microcomputer, the user may also be the operator.

UTILITY PROGRAM Frequently used, special-purpose programs usually supplied by the system vendor. Utility programs edit data, diagnose problems, manipulate files, etc.

VENDOR (Computer) The salesperson, or organization he or she represents, who sells computer hardware or software or both.

VERTICAL MARKET PACKAGE see Functional Package.

VDT (VIDEO DISPLAY TERMINAL) see CRT.

VDU (VIDEO DISPLAY UNIT) see CRT.

VOLATILE MEMORY Memory that does not retain its contents when the computer is turned off, i.e., RAM. "Permanent" or non-volatile memory does retain its contents, e.g., ROM.

WINCHESTER DISK see Hard Disk.

WINDOW A segment of the CRT screen used to display information independently of the display on the rest of the screen. (The effect is analogous to TV programs where a split screen shows the viewer two or more separate pictures at the same time.) The isolated segment of the screen is considered to be a "window" into the computer's memory.

WORD Used in connection with computers, a 'word' refers to the "clump" or "package" of data that the CPU handles as a single logical unit. A word has a fixed number of bits. Early microprocessors handled 8 bits of data at a time. A microcomputer with this word size thus has an 8-bit processor. The newer machines have 16- or 32-bit microprocessors. Since they "think about" and move data around in larger chunks, they are usually faster and more powerful than 8-bit microprocessors.

WORD PROCESSING The computerized entry, processing and output of text. The text can be readily re-arranged and corrected. Word processing can be done on a microcomputer using a word processing package, or on a dedicated word processor. The latter equipment, unlike a general-purpose microcomputer, is specifically designed to process text (i.e., it has special features on the keyboard, screen and in the software).

WRITE The computer or an output device writes a record by magnetizing dots in a coded pattern. It works in much the same way as a tape recorder. Writing is the process by which information is copied from RAM onto a storage device (disk, diskette or tape) or output device (display screen or printer).

APPENDIX B

HELP: SOURCES OF INFORMATION/ADVICE, AND EDUCATION/TRAINING

This appendix describes sources of information and advice, as well as education and training, with regard to microcomputers and their use in municipalities and in general.

INFORMATION AND ADVICE

Depending on what point you have reached on the road to installing a microcomputer, you are likely to turn to different sources for information and advice. Your chief sources during the feasibility, requirements definition, and selection phases are likely to be other municipalities that have installed microcomputers, this Guide and other ministry publications about microcomputers, the staff of the ministry's field offices, and members of the Municipal Information Systems Association. You may also have obtained information and advice from your municipal auditor, council, educational institutions, businesses, or individuals in your community.

The software vendor should provide information, advice and training for both software and hardware.

You may well want to learn something about microcomputers before commencing a study for your municipality. Or you or staff members may feel the need for additional training after the microcomputer project has begun.

1. Ministry of Municipal Affairs and Housing Publications

A bibliography of Ontario Government publications concerning computers is provided at the end of this appendix. Comments on some of the publications follow.

As explained in the Preface, two series of publications have been produced: Microcomputers in Small Municipalities, and Microcomputers in Local Government. The latter series is intended for larger municipalities.

The series for small municipalities comprises four publications: This Guide, its companion volume, the Workbook, the Catalogue and the Case Studies. These will be available by the second quarter of 1984.

The Catalogue tells you the names of Ontario municipalities that have installed microcomputers, what applications they are running on their microcomputers, and what hardware they are using. It also provides information on the hardware and software vendors whose products are in use in Ontario municipalities. The Catalogue thus provides you with sources of user information as well as vendor information.

Microcomputers in Small Municipalities: Case Studies describes the experiences of several municipalities in selecting, acquiring and using micros. This publication may save you a lot of headaches - and unnecessary expense - since it describes the lessons learned by people who have already gone through the processes of installing a microcomputer and getting it to work.

You may want to take a look at Microcomputers in Local Government: A Manual. It deals with more complex microcomputer systems. The Ministry also produced a guide to the use of mainframe computers in Ontario a few years ago. It is entitled Using Computers: A Guide for Municipalities in Ontario, and was last reprinted in March, 1982. Even though it focuses on mainframes, it covers many topics that are pertinent to microcomputer installations, especially if you are thinking of using your microcomputer as a central computer. If you want to supplement the information presented in this Guide, Using Computers will prove helpful.

Councillors who want to gain a wider general understanding of computers and all that is entailed in installing a computer of any kind will find it useful, too.

Much shorter publications, Bulletin No. 22: Minicomputers, and Bulletin No. 34: Word Processing, are also available. One copy of each of these Ministry publications has been sent to every municipality.

Additional copies of all government publications are obtainable (by mail, prepaid) from:

Ontario Government Bookstore
Publications Centre
880 Bay Street, 5th Floor
TORONTO, Ontario
M7A 1M8

Phone: 965-6015; Toll-Free: 1-800-268-7540;
Northwestern Ontario: 0-Zenith-67200

2. Ministry of Municipal Affairs and Housing Advisory Services

The Ministry can help by supplying:

- current information as to municipal applications and microcomputer installations
- names of contacts in other municipalities
- additional resource material
- further advice and assistance in getting started.

Note that the Ministry has a collection of sample charts of accounts. There may be no need to create one; if you wish, you can use or adapt a sample already used by another municipality. The Ministry's field offices maintain a repository of bylaws. These samples could save you time when drafting new bylaws or revising old ones. Contact the Field Office in your area for more information. Addresses are listed in the back of the Guide.

3. Canadian Sources of Computer Systems and Services

The Government of Ontario is actively encouraging public organizations to purchase Canadian goods. In the words of the Minister of Industry and Trade, the Honourable Frank S. Miller:

> The Ontario Government is concerned with the creation of jobs and investment in Canada. My Ministry has a number of programs designed to accomplish this objective. In one of our programs we strongly encourage all Ontario public bodies to maximize the Canadian content of the goods and services they acquire.
>
> To purchase Canadian-produced goods, public buyers must first have a good knowledge of Canadian producers and their products. In many cases failure to buy Canadian-produced goods in the past has been the result of public buyers not knowing that they were available*.

Accordingly, the Ministry of Industry and Trade has published a directory entitled Computer Systems Sources: An Ontario Guide to Canadian Producers of Computers, Word Processors and Components, Software and Services; Also Consultants. The Directory lists hardware manufacturers, software producers, distributors of hardware and software, and consulting services. A profile of each company is also provided.

A copy of this Directory has been sent to every municipality in Ontario.

The Ministry has also produced directories of Canadian sources for audio-visual products and institutional equipment and products. All of these publications are available from the Ontario Government Bookstore.

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*Message from the Minister of Industry and Trade, in Computer Systems and Sources.

through reviews of both hardware and software products and through advertisements.

Be aware that U.S. magazines quote U.S. prices. The same products are likely to cost much more in Canada. As a rule of thumb, you can take the U.S. dollar price, and add 50% to it to estimate the Canadian dollar equivalent.

Some Canadian magazines that deal with computers and microcomputers in a business or administrative setting are ComputerData, InfoAge, and Computing Canada. American magazines include Byte, Interface Age, Desktop Computing, Infoworld and PC: The Independent Guide to IBM Personal Computers. These titles are only a sample - there are many more.

EDUCATION AND TRAINING

Education and training needs will differ, of course, depending on how much you and your staff already know about using computers in general and microcomputers in particular, and what your plans are.

Most people find that, even with excellent training, it takes time and practice to become fully conversant with a microcomputer system. So microcomputer users have to expect to teach themselves, to some extent at least, and to be willing to put in the necessary time and effort. Possible sources of training for general computer education and for hardware and generic packages are summarized in Exhibit 7, overleaf. As pointed out earlier, the software vendor who supplies your functional packages should conduct demonstrations and supply training materials.

EXHIBIT 7

SOURCES OF EDUCATION AND TRAINING

SOURCE	TYPE OF TRAINING		
	GENERAL EDUCATION	EQUIPMENT OPERATION	GENERIC PACKAGES
1. HARDWARE VENDOR		TUTORIALS, DEMONSTRATIONS, MANUALS	
2. SOFTWARE VENDOR			DEMONSTRATION (ON-SITE; AT RETAIL STORE)
3. INDEPENDENT SEMINARS (NON-MUNICIPAL)	1-3 DAY COURSES ON BASIC MICROCOMPUTER CONCEPTS	1/2-1 DAY COURSES ON BASIC MICROCOMPUTER CONCEPTS	1-3 DAY COURSES ON ELECTRONIC SPREADSHEETS AND INTEGRATED PACKAGES (COMBINING SPREADSHEETS, GRAPHICS AND WORD PROCESSING)
4. EDUCATIONAL INSTITUTIONS (COMMUNITY COLLEGES AND HIGH SCHOOLS)	MAY OFFER COURSES ON BASIC MICROCOMPUTER CONCEPTS, AND PROGRAMMING		MAY OFFER COURSES ON USING WORD PROCESSING, OR ELECTRONIC SPREADSHEETS OR DATA BASE PACKAGES
5. PROFESSIONAL ASSOCIATIONS e.g., MISA	ANNUAL CONFERENCES		
6. COMMERCIALLY PRODUCED TRAINING COURSES FOR SELF-STUDY	VIDEO AND COMPUTER-AIDED INSTRUCTION PACKAGES ON BASIC MICROCOMPUTER CONCEPTS	VIDEO AND COMPUTER-AIDED INSTRUCTION PACKAGES ON HOW TO OPERATE A MICROCOMPUTER	VIDEO AND COMPUTER-AIDED INSTRUCTION PACKAGES ON USING WORD PROCESSING, ELECTRONIC SPREADSHEETS, DATA BASE, AND INTEGRATED PACKAGES

Annual conferences, as well as seminars, meetings and workshops, held by municipal organizations often include sessions on computer topics that may be of value to you. Municipal people have also combined forces to arrange local seminars and workshops, with Ministry assistance. These are worth watching out for.

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Ontario. Ministry of Municipal Affairs and Housing. Municipal Operations Division. (Management Advisory Publications)

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- Microcomputers in Local Government: A Workbook. 1984. (To be published)
- Microcomputers in Local Government: A Catalogue. 1984. (To be published)
- Microcomputers in Local Government: Case Studies. 1984. (To be published)
- Using Computers: A Guide for Municipalities in Ontario. 1980. Reprinted 1982. 237 p. $4.50.
- Directory of Computers and Applications in Ontario Municipalities. 1981. 167 p. $6.00.
- Local Government Bulletin No. 22: Minicomputers. March 1979. 22 p. (The Local Government Bulletin Series is now called the Municipal Management Bulletin Series.) $1.00.
- Getting More for Your Consulting Dollars: A Guide For Municipalities in Ontario. 1977. 47 p. $3.00.

Ministry of Municipal Affairs and Housing Research and Special Projects Branch.

- The Use of Computers in Planning: An Overview of the Ontario Situation. March 1983. 48 p. $3.00.
- The Use of Microcomputers in Planning. (This is a working title. To be published later in 1984)

2. MINISTRY PUBLICATIONS ON RELATED TOPICS

Ontario. Ministry of Municipal Affairs and Housing. Municipal Operations Division.

- Basic Accounting Package: BACPAC. 1983. 2 v. $15.00.
- Financial Procedures Bulletin F.6: Property Taxation - Billing and Collection. August, 1980. 43 p. $1.00.
- Local Government Bulletin No. 34: Word Processing. (Now called Municipal Management Bulletin) October, 1979. 24 p. $1.00.

3. OTHER GOVERNMENT OF ONTARIO PUBLICATIONS

Ministry of Industry and Trade. Office of Procurement Policy. Computer Systems Sources: An Ontario Guide to Canadian Producers of Computers, Word Processors and Components, Software and Services; Also Consultants. 1984.

4. OTHER PUBLICATIONS

Griesemer, James R. Microcomputers in Local Government. (Practical Management Series). Washington, D.C.: International City Management Association, 1983. 148 p.

International City Management Association, Washington, D.C. Directory of Data Processing in Small Local Governments. (Management Information Service Special Report). Washington, D.C.: The Association, 1978. 123 p.

Illustrated Computer Dictionary for Use in Every Home, Office, School, by the Editors of Consumer Guide. Publications International Limited, 3841 West Oakton Street, Skokie, Illinois 60076, USA. 1983. 180 p.

Foundation for the Technical Advancement of Local Government Engineering in Victoria (Australia). Computer Technology in Local Government, by Eric W. Howard, Deputy Shire Engineer, Shire of Bulla; Municipal Offices, Macedon Street, Sunbury, P.O. Box 42, Victoria 3429, Australia. 125 p.

APPENDIX C
TRADE MARKS AND REGISTERED NAMES

The names of the following products referred to in this Guide or in the Workbook are trade marks and registered names.

PRODUCT NAME	TRADE MARK OWNER
CP/M, CP/M-80, CP/M-86, Concurrent CP/M	Digital Research Inc.
Info Globe	Division of the Globe and Mail
Lotus 1-2-3	Lotus Development Corporation
MS-DOS	Microsoft Inc.
PC-DOS	IBM
UNIX	Bell Laboratories Inc.
VisiCalc	VisiCorp
WordStar	MicroPro International Inc.
Xenix	Human Computing Resources Corp.

For more information, write or call any of the field offices of the Municipal Operations Division. They are located at these addresses.

CAMBRIDGE

150 Main Street
Cambridge, Ontario
N1R 6P9
(519) 622-1500

OSHAWA

74 Simcoe St. S.
Oshawa, Ontario
L1H 4G6
(416) 571-1515

GUELPH

147 Wyndham St. N.
4th Floor
Guelph, Ontario
N1H 4E9
(519) 836-2531

KINGSTON

1055 Princess St.
Kingston, Ontario
K7L 5T3
(613) 547-2203

LONDON

495 Richmond St.
London, Ontario
N6A 5A9
(519) 438-7255

OTTAWA

244 Rideau St.
Ottawa, Ontario
K1N 5Y3
(613) 566-3711

NORTH BAY

347 Sherbrooke Street
North Bay, Ontario
P1B 2C1
(705) 476-4300

SUDBURY

430 Notre Dame Avenue
2nd Floor
Sudbury, Ontario
P3C 5K7
(705) 675-4343

ORILLIA

15B Matchedash St. N.
Orillia, Ontario
L3V 4T4
(705) 325-6144

THUNDER BAY

435 James St. S.
P.O. Box 5000
Thunder Bay, Ontario
P7C 5G6
(807) 475-1621

TORONTO

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777 Bay Street
Toronto, Ontario
M5G 2E5
(416) 585-7201

Any questions or comments regarding the contents of this publication may be addressed to the Ministry at the above Toronto address and telephone number.

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